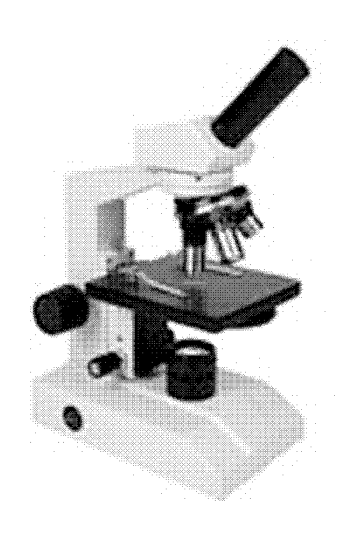
MEDICAL AND BIOLOGICAL TERMINOLOGY

FOR

UNDER AND POST- GRADUATE STUDENTS
OF MEDICINE, PHARMACY, SCIENCE,
GENETICS, BIOLOGICAL SCIENCES

(English - Simple English)

مكتبـة الإيمـان - المنصـورة
ت : ٢٢٥٧٨٨٢



BY

DR NABIL MOHIE ABDEL - HAMID

PROFESSOR OF BIOCHEMISTRY, COLLEGE OF PHARMACY, EL MINIA, EGYPT

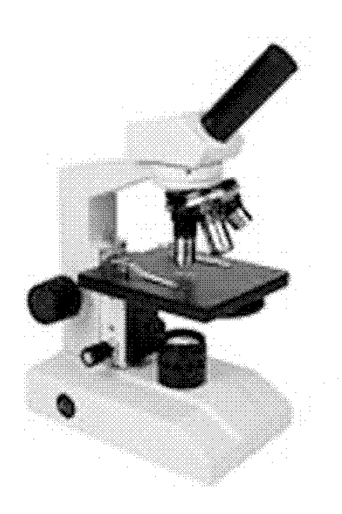
المصطلحات الطبية والبيولوجية

للطلبة و طلاب الدراسات العليا

فى الطب و الصيدلة و العلوم و الوراثة

والعلوم البيولوجية

(إنجليزى - إنجليزى مبسط)

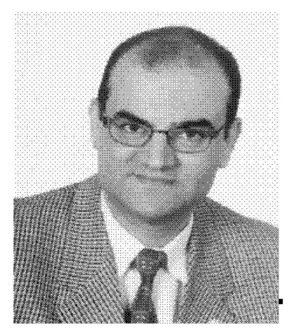


للدكتـــور

نبيـــــل محــيى عبـد الحميـــــد

أستاذ الكيمياء الحيوية و التحاليل الطبية

بكلية الصيدلة - جامعة المنيا - مصر



المـؤلف فى سطـور :

- **من مواليـد الدقهلية عام ١٩٦٢ .**
- **ماجستير فى كيمياء المخ و علاج الإكتئاب .**
- **دكتوراه فى التسمم الكبدى من الأدوية و آثار الأدوية عليـه .**
- **أستـاذ الكيميـاء الحيوية و التحاليل الطبية بصيدلـة المنيا .**
- **رئـيس هيئـة التحريـر للمجلـة الدوليـة للكيميـاء الحيويـة والفسيولـوجية وموقعهـا علـى الشبكة الدوليـة للمعلومـات هو :** www.IJBPC.Com
- **و لـه صـفحة علـى الشـبكة الدوليـة عنوانهـا :** http://nabil.IJBPC.Com
- **عضو الجمعية الأمريكية للكيمياء الحيوية و البيولوجيا الجزيئيـة.**
- **عضو الجمعية الأمريكية للكيمياء .**
- **عضو الإتحـاد الـدولى للكيمياء الإكلينيكيـة (السريرية) .**
- **عضو الإتحـاد العربـى للبيولـوجيـا الإكلينيكيـة (السريرية) .**

- **عضو الجمعية المصريـة الأمريكية للكيمياء الحيوية و البيولوجيا الجزيئيـة .**
- **عضو الجمعية المصرية لعلوم السمـوم .**
- **عضو الرابطة المصـرية للسكـر .**
- **العضـو المصـرى الوحيـد للمـؤتمر الأوروأسـيوى الثـانى للنـواتج الطبيعية و المواد النشطة وظيفيا فى منطقة سيبريا فى روسيا .**
- **تلقى دعوة من المـؤتمر الـدولى عن علـوم البيئـة فى كـازيميرز - بولندا .**
- **تلقـى دعـوة مـن المـؤتمر الـدولى عـن الكيميـاء و الفقـر فـى دار السلام - تنزانيا.**
- **تلقى دعـوة من المـؤتمر الـدولى عن العلـوم االطبيـة فـى أنتاليـا - تركيا .**
- **تلقى دعـوة مـن المـؤتمر الـدولى عن الوراثـة النباتيـة فى فيينـا - سويسـرا.**
- **تلقـى دعـوة مـن المـؤتمر الـدولى عـن العلـوم الطبيـة بالقـدس - فلسطين .**

إضافة إلى عديد من المؤتمرات داخل جمهورية مصر العربية .

- لـه عديـد مـن الأبحـاث المنشـورة فـى مجـلات علميـة مصـرية - روسية - بولندية - سويسرية .
- عمل بالمركز الطبى لجامعة الإمام محمد بن سعود بالرياض - السعودية .
- عمـل كبيـرا لصـيادلة مستشـفى أمريكـى - سـعودى بجـدة - السعودية.
- لديـه مركـزا للتحاليـل الطبيـة بالدقهليـة : تليفونـه : 002/050/6913997.
- البريد الإليكترونى : nabilmohie@yahoo.com.
- له كتب علمية متخصصة : مثل : تحـدى الأمراض بالثـوم .

و كتب بعنـوان : كيف تقوى مناعتك بالإعشـاب .

و كتاب الإيمـان قبل الأديان .

و روايـة : حـب بلا دمـوع .

و كتـاب الكيميـاء الحيوية لطلاب الطب و الصيـدلـة .

وجارى إعداد كتاب بعنوان : الأمراض الوراثية و علاقتها بالزواج .

- و هذه قائمة بأبحاثه المنشورة :

1- Abdel- Hamid, N. M; Amin, R. S and Abdallah, F. R (2002):

Serum Ferritin, Folate and Cyanocobalamin Levels as Novel Markers for Ibuprofen - Induced Alopecia In Rats. Arab J Lab Med, 28 (1): 65 - 72.

2 - El -Sweidy, M.M; Abdallah. R; Amin, R .S and Abdel- Hamid, N. M (2002) : Prolonged Intake of Acetyl Salicylic Acid and Its Metabolic Consequences in Rats. Arab J Lab Med, 28 (2): 177 - 186.

3-El - Sweedy, M.M, Abdallah, F. R and Abdel- Hamid, N. M (2000): The Use of Fibronectin and Chondroitin Sulphate Rather than Liver Enzymes as Markers for Liver Damage in Individuals Exposed To Certain Occupational Hazards. Zagazig J Pharm Sci,

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5- Faddah L. M.H. ; Abul -Naga Y. A. ; Abdel-Hamid, N. M and Mahmoud A. W (2002) : Possible Hepatoprotective Combinations of Diphenyl Dimethyl Bicarboxylate (DDB) with Some Antioxidants in Carbon Tetrachloride Intoxicated Rats. The Egyp J of Biochem and Mol Biol, Vol 20, Special Issue: 105 - 113.

6 - Abdel- Hamid, N. M (2003): Considerable Biochemical Reasons for Possible Ibuprofen - Induced Alopecia in Rats. J Egyp Soc Toxicol, Vol. 29: 71 - 75.

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8 - El -Sweidy, M.M; Abdallah. R and Abdel-Hamid, N. M (2004): The Use of New Markers For The Detection of Liver Damage in Experimental Rats Administered Certain Heavy Metals. Egyp Pharm J, 9: 131 - 141. (Cited on the Internet) .

9 - El -Sweidy, M.M; Abdallah. R and Abdel-Hamid, N. M (2002) Biochemical Study on Some Hepatotoxic Agents in Rats. J Egyp Soc Toxicol, Suppl to Vol. 28: 40 - 54.

10 - Amin, R. S; Abdallah, F. R and Abdel-Hamid, N. M (2004): Variations in Some Blood Minerals Related to Bone Remodeling and

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12 - Abdel- Hamid , N. M and Tarabanko , V.E (2004) :Radio protective Effect of an Egyptian Wild Herb Ambrosia maritima L (Damsissa) : Biochemical Study on Neurotransmitters . Journal of Chemistry of Raw Plant Materials, 2004, 4: 53-58. (Russian).

13 - Abdel - Hamid, N. M: Diphenyl Dimethyl Bicarboxylate as an Effective Treatment For Chemical-Induced Fatty Liver In Rats . Under-Publication.

14- Challenge Diseases by Garlic. An Arabic Book published by Al-Ahrams Press.

15 - How can you potentiate your Immunity with Herbs? An Arabic Book under publication.

Memberships:

- **Egyp Soc Clin Chem.**
- **International Federation of Clin Chem.**
- **Egyp Soc Biochem and Mol Biology.**
- **Egyp Foundation of Diabetes.**
- **Egyp Soc of Toxicol.**
- **American Society of Biochemistry and Molecular Biology.**
- **American Society of Chemistry.**

Index

مقــدمـــة

هـذا الكتــاب يمثـل نقلــة جديـدة يمكـن أن تضــاف إلــى قائمــة كتـب المصطلحات العلمية المتخصصة في العلـوم الطبيـة والصيدلية والوراثـة والزراعة والعلوم البيولوجية الأخرى .

وقد تميز عن سابقيه في تقديم المصطلحات العلميـة التـي غالبـا مـا تكون لاتينيـة الأصل فـي لغـة إنجليزيـة سـهلة يسـهل استخدامها كوسيلة للتعبير عند الطلاب ودارسي الدراسات العليا ويجب اقتناؤه لكل من يعمل في حقول الطب والعلوم والصيدلة وخصوصا علوم الوراثة التي أصبحت أساسا هاما في جميع أفرع الطب والصيدلة والتصنيع الدوائي والـهندسـة الوراثية بجميع فروعها وتطبيقاتها . لأنـها أصبحت ضرورة ملحة لجميع طلاب المنح العلمية خارج القطر .

هذا ، ولم يجد المؤلف فائدة في التعريب لأنـه لا يعد ترجمـة ، بـل هـو نطق للكلمـة بلغتهـا الأصلية مـع كتابتهـا بلغـة عربيـة . والتعريـب بـهذه الطريقة قد يؤدى تباعا إلـى عزلــة علميـة للدارس فلا يستطيع أن يتـابع الكتب والدوريات العالمية والمؤتمرات والتطور المذهل فـي علـوم الطـب والاستنساخ والأمراض الوراثية .

وبهذا الكتاب يستطيع الدارس أن يفهم الكلمات الصعبة بسهولة تامة مع الاستعانة ببعض الصور والأشكال التوضيحية ليقوم بنفسه بصياغة المعلومة بشكل مبسط يسهل تعلمه وتعليمه .

والله الموفق

دكتــور

نبيل محيى عبد الحميد على

أستاذ الكيمياء الحيوية والتحاليل الطبية بصيدلة المنيا

عضو الجمعية المصرية و الإتحاد الدولى للكيمياء الحيوية

والبيولوجيا الجزيئية

عضو الجمعية المصرية للسكر

عضو الجمعية المصرية لسموم الأدوية

- ت/ معمل : ٠٥٠٦٩١٣٩٩٧ - ميت غمر (دقهلية)

- ش: ابطال الفالوجا متفرع من ش : الجيش

- ت: محمول: ٠١٠٦٤٢٦٩٩٨

- بريد إليكتروني : nabilmohie@yahoo.com

COMMON INTERNATIONAL UNITS AND PREFIXES

Power of 10	Prefix	Symbol
101	dek	da (small)
102	hecto	h (small)
103	kilo	k (small)
106	mega	M (capital)
109	giga	G (capital)
1012	tetra	T (capital)
1015	Petra	P (capital)
1018	exa	E (capital)
10 -1	deci	d (small)
10 -2	centi	c (small)
10 -3	milli	m (small)
10 -6	micro	μ
10 -9	nano	n (small)

10 -12	**pico**	**p**	**(small)**
10 -15	**femto**	**f**	**(small)**
10 -18	**atto**	**a**	**(small)**

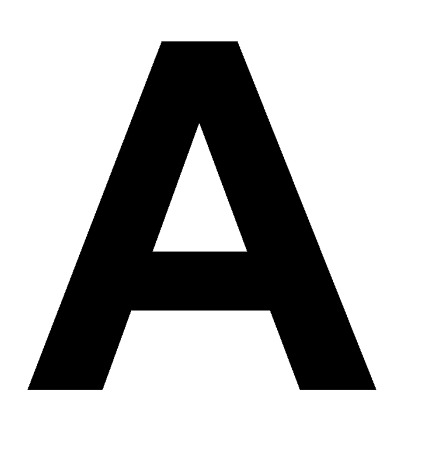
SI units : i.e. : System International d'unit (French) , or International System of units (English) .Abbreviations and their values : (Which is small or capital letters) , meter (m) , kilometer (km) , inch (in) , centimeter (c) , Litre (L) , gram (g) . kilogram (kg) , millilitre (mL) , decilitre (dL) , microgram (mcg = µg) , Centigrade (º C).

One of the traditionally used units is part per million (ppm) which is one milligram / Liter.

Please note these Greek Letters that are mostly and frequently used in scientific fields

Capital Letter	Small Letter	Pronunciation
Α	α β	Alpha
Β	γ	Beta
Γ	δ	Gamma
Δ	ε	Delta
Ε	ζ	Epsilon
Ζ	η	Zeta
Η	θ	Eita
θ	ι	Theta
Ι	χ	Utah
Κ	λ	Kapa
Λ	μ	Lambda

Μ	ν	Meo
Ν	ξ	Neo
Ξ	ο	Eczai
Ο	π	Amicron
Π	ρ	Be
Ρ	σ	Row
Σ	τ	Sigma
Τ	Υ	Taw
Υ	Φ	Yepsilon
Φ	χ	Fai
Χ	ψ	She
Ψ	ω	Bis
Ω		Omega



Abduction: Moving an extremity away from the body.

Abiotic Degradation: Breakdown of a chemical by processes other than living organisms, such as photodegradation and chemical reactions (e.g. hydrolysis).

Abrasion: An area of skin or mucous membrane worn from the body mechanically by some unusual or abnormal process.

Abscess: A localized collection of pus.

Absorbed Dose: The amount of a substance that actually enters into the body, usually expressed as milligrams of substance per kilogram of body weight (mg/kg).

Absorbent: A drug which “takes up” other substances by absorption.

Absorption: The process whereby a substance moves from outside the body into the body.

Acceptable Daily Intake (ADI): The amount of a chemical to which a person can be exposed each day over a long period of time (usually lifetime) without suffering harmful effects.

Acetyl CoA : Small, water-soluble metabolite comprising an acetyl group linked to coenzyme A (CoA); formed during oxidation of pyruvate, fatty acids, and amino acids. Its acetyl group is transferred to citrate in the citric acid cycle.

Acetylcholine (ACh): Neurotransmitter that functions at vertebrate neuromuscular junctions and at various neuron-neuron synapses in the brain and peripheral nervous system. It is an important chemical in the body having physiological functions, including the neurotransmission of electrical impulses across synapses of nerve endings.

Acetylcholinesterase: An enzyme presents in nervous tissue, muscle, and red blood cells that catalyzes the hydrolysis of acetylcholine to choline and acetic acid.

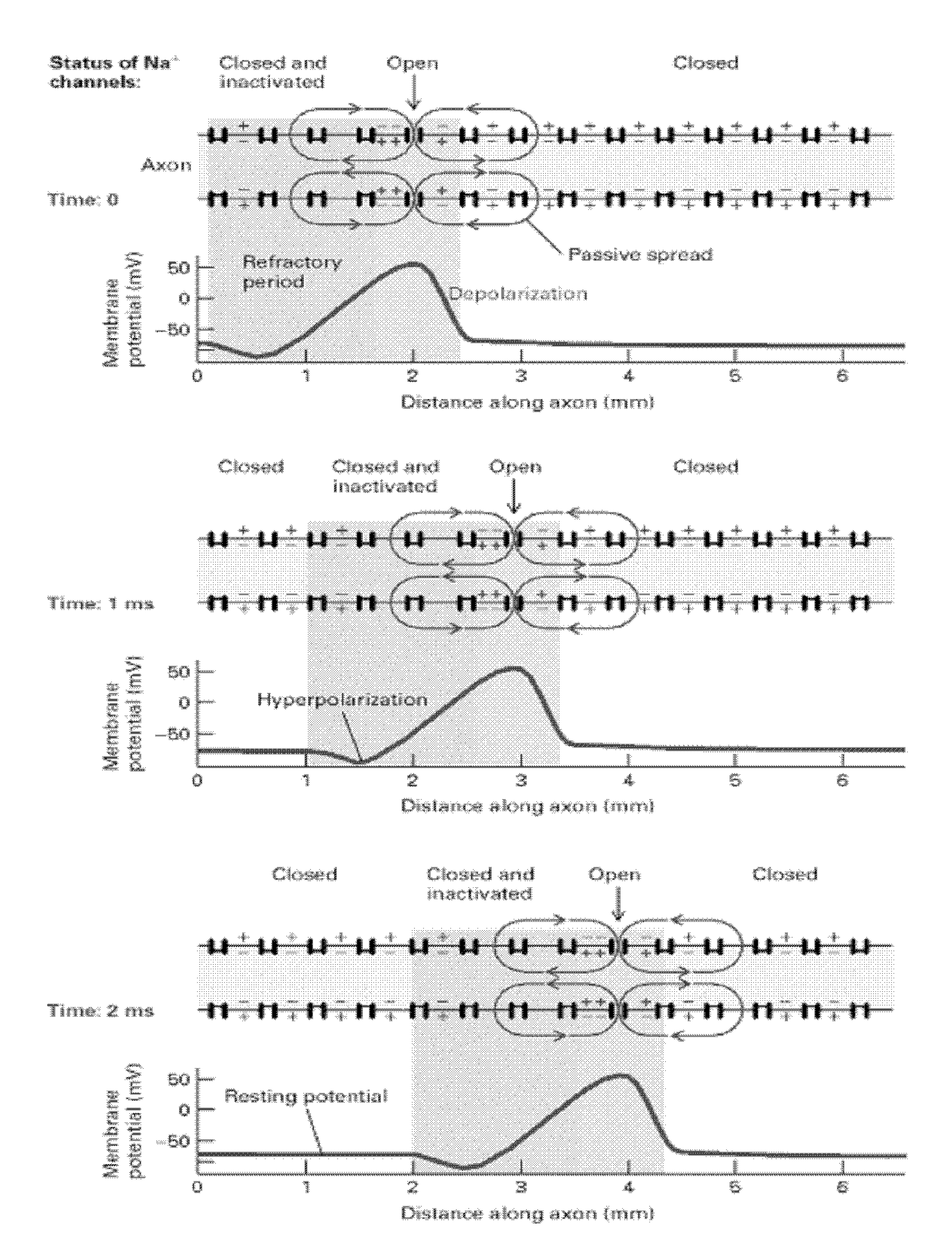
ACGIH: American Conference of Governmental Industrial Hygienists. It is professional society for industrial hygienist that recommends safety and health guidelines.

Acid : A compound that can donate a proton (H+). The carboxyl and phosphate groups are the primary acidic groups in biological molecules.

Acidosis: A condition resulting from acid accumulating in the body.

Actin: Abundant structural protein in eukaryotic cells that interacts with many other proteins. The monomeric globular form (G actin) polymerizes to form actin filaments (F actin). In muscle cells, F actin interacts with myosin during contraction.

Action potential: Rapid, transient, all-or-none electrical activity that is propagated in the plasma membrane of excitable cells such as neurons and muscle cells. Action potentials, or nerve impulses, allow long-distance signaling in the nervous system.


Status of Na⁺ channels:
Closed and inactivated
Open
Closed
Axon
Time: 0
Passive spread
Refractory period
Depolarization
Membrane potential (mV)
50
0
−50
0 1 2 3 4 5 6
Distance along axon (mm)
Closed
Closed and inactivated
Open
Closed
Time: 1 ms
Hyperpolarization
Distance along axon (mm)
Closed
Closed and inactivated
Open
Closed
Time: 2 ms
Resting potential
Distance along axon (mm)

Activation energy: The input of energy required to (overcome the barrier to) initiate a chemical reaction. By reducing the activation energy, an enzyme increases the rate of a reaction.

Active site: Region of an enzyme molecule where the substrate binds and undergoes a catalyzed reaction.

Active transport: Energy-requiring movement of an ion or small molecule across a membrane against its concentration gradient or electrochemical gradient. Energy is provided by the coupled hydrolysis of ATP or the cotransport of another molecule down its electrochemical gradient.

Acute Dose: The amount of a substance administered or received over a very short period of time (minutes or hours), usually within 24 hours.

Acute Effect: An effect that occurs almost immediately (hours/days) after a single or brief exposure to a toxic agent. Generally, acute effects will be evident within 14 days.

Adduction: Bringing an extremity toward the body.

Adenosine triphosphate: ATP

Phosphoanhydride bonds

Adenosine triphosphate (ATP)

Adenylyl cyclase: Membrane-bound enzyme that catalyzes formation of ATP.

Adipose: Of a fatty nature.

Adrenergic: Activated by, characteristic of, or secreting epinephrine or similar substance.

Adsorption: The process of attracting and holding a substance to a surface. For example, a substance may adsorb onto a soil particle.

Adverse Reactions to Drug Report: A report which is voluntarily submitted by physicians to the FDA after a drug has been approved and in use.

Aerobic: Referring to a cell, organism, or metabolic process that utilizes O2 or that can grow in the presence of O2.

Aerobic oxidation: Oxygen-requiring metabolism of sugars and fatty acids to CO2 and H2O coupled to the synthesis of ATP.

Aerosols: Aerosols are airborne particulates. They may be solids or liquid droplets.

Affect (n): Feeling experienced in connection with an emotion.

Albuminuria: Albumin in the urine.

Alimentary: Pertaining to food or digestion.

Alkalosis: A pathogenic condition resulting from accumulation of base in, or loss of acid from, the body.

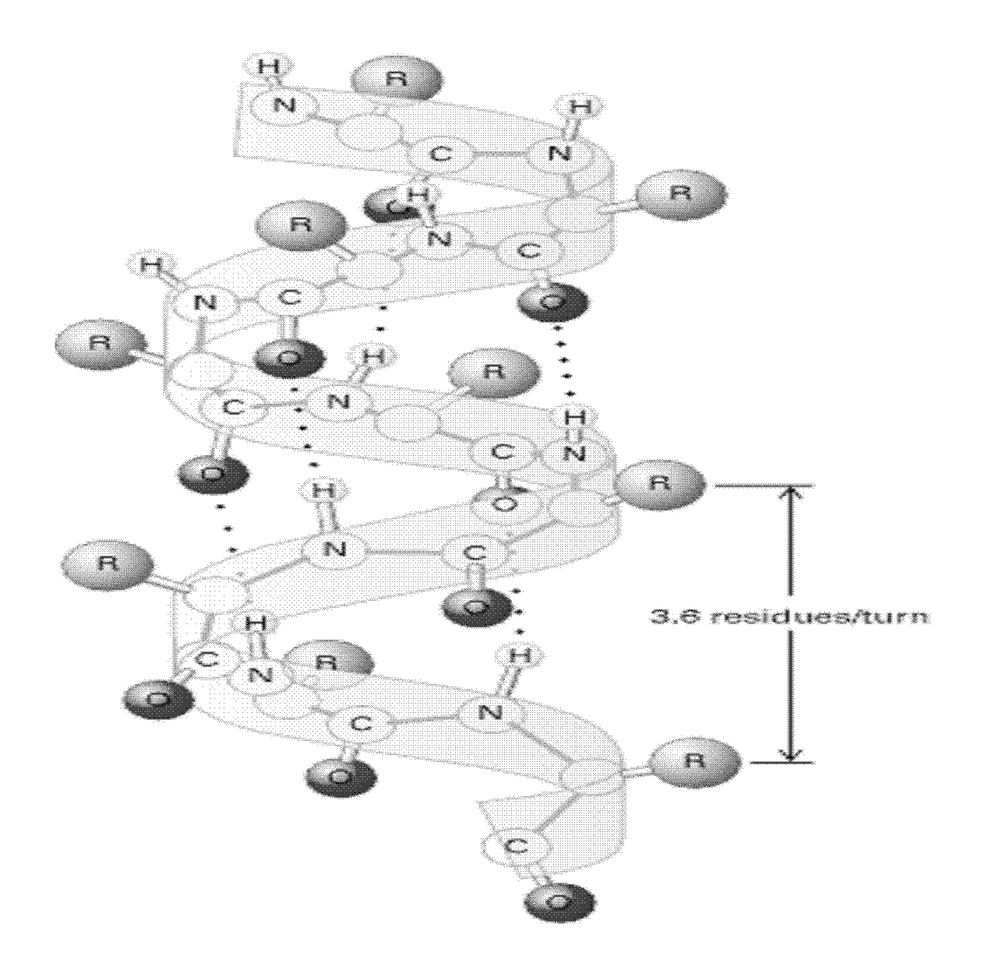
Allele: One of two or more alternative forms of a gene located at the corresponding site (locus) on homologous chromosomes.

Allergy : An immune hypersensitivity reaction of body tissues to allergens that can affect the

skin (urticaria), respiratory tract (asthma), gastrointestinal tract (vomiting and nausea) or produce a systemic circulatory response (anaphylactic response).

Allosteric transition: Change in the tertiary and/or quaternary structure of a protein induced by binding of a small molecule to a specific regulatory site, causing a change in the protein's activity. Allosteric regulation is particularly prevalent in multisubunit enzymes.

Alpha (α) helix: Common secondary structure of proteins in which the linear sequence of amino acids is folded into a right-handed spiral stabilized by hydrogen bonds between carboxyl and amide groups in the backbone.



Alveoli: The air sacs at the ends of the tracheo-bronchial tree in which gases are exchanged between inhaled air and the pulmonary capillary blood.

Ambient environment: The surrounding environment. This can refer to ambient air, ambient water, or ambient soil.

Ambulatory: Walking or able to walk.

Ames test: A test for mutagenesis using the bacterium, Salmonella typhimurium.

Amino acid: An organic compound containing at least one amino group and one carboxyl group. In the 20 different amino acids that compose proteins, an amino group and carboxyl group is linked to a central carbon atom, the carbon, to which a variable side chain is bound.

HYDROPHILIC AMINO ACIDS

Basic amino acids

Lysine (Lys or K)

Arginine (Arg or R)

Histidine (His or H)

Acidic amino acids

Aspartic acid (Asp or D)

Glutamic acid (Glu or E)

Polar amino acids with uncharged R groups

Serine (Ser or S)

Threonine (Thr or T)

Asparagine (Asn or N)

Glutamine (Gln or Q)

HYDROPHOBIC AMINO ACIDS

Alanine (Ala or A)

Valine (Val or V)

Isoleucine (Ile or I)

Leucine (Leu or L)

Methionine (Met or M)

Phenylalanine (Phe or F)

Tyrosine (Tyr or Y)

Tryptophan (Trp or W)

SPECIAL AMINO ACIDS

Cysteine (Cys or C)

Glycine (Gly or G)

Proline (Pro or P)

Aminoacyl-tRNA: Activated form of an amino acid, used in protein synthesis, consisting of an amino acid linked via a high energy ester bond to the 3′-hydroxyl group of a tRNA molecule.

Amphipathic: Referring to a molecule or structure that has both a hydrophobic and a hydrophilic part.

Anabolism : The constructive process by which the simple products of digestion are converted by living cells into more complex compounds and living matter for cellular growth and repair. This cellular process requires energy.

Anaerobic: Referring to a cell, organism, or metabolic process that functions and growing only in the absence of O2.

Analgesic: A drug used to relieve pain without producing unconsciousness or impairing mental capacities.

Anaphase: Mitotic stage during which the sister chromatids (or paired homologs in meiosis I) separate and move apart (segregate) toward the spindle poles.

Anatomy: The science of the structure of the body and the relationship of its parts to each other.

Anemia: A condition in which there is reduced or impaired red blood cells or hemoglobin resulting in an inadequate capacity of the blood to transport oxygen to body tissues. It is also a decrease in certain elements of the blood, especially red cells and hemoglobin.

Anesthesiologist: A physician who specializes in anesthesiology.

Anesthesiology: A branch of medicine that studies anesthesia and anesthetics.

Anesthetist: A registered nurse trained in administering anesthetics.

Aneuploidy: Any deviation from an exact multiple of the haploid number of chromosomes. This may involve missing or extra chromosomes or parts of chromosomes.

Anisocoria: Unequal diameter of the pupils.

Anodyne: A drug that relieves pain.

Anorexia: Loss of appetite.

Anoxia: An insufficient (below normal) supply of oxygen in the body tissues.

Antagonism: An interaction between two chemicals in which one decreases the expected toxic effect of the other.

Nthelmintic: A drug that expels, paralyzes, or kills intestinal worms.

Antibiotic: A synthetic product or a product of living microorganisms that kills or inhibits the growth of undesirable microorganisms.

Antibody: An antibody is a protein molecule (immunoglobulin with a unique amino acid sequence) that only interacts with specific or closely related foreign substances (antigen). The antibody is induced (a response of the immune system) as a result of prior exposure to the antigen. It also interacts with a particular site (epitope) on the antigen and facilitates clearance of that antigen by various mechanisms.

Anticholinergic Effects: Neurological effects resulting from the blockage of acetylcholine which transmits impulses across nerve junctions.

Anticodon: Sequence of three nucleotides in a tRNA that is complementary to a codon in an mRNA. During protein synthesis, base pairing between a codon and anticodon aligns the tRNA carrying the corresponding amino acid for addition to the growing peptide chain.

Antidote: An agent or remedy that counteracts a poison.

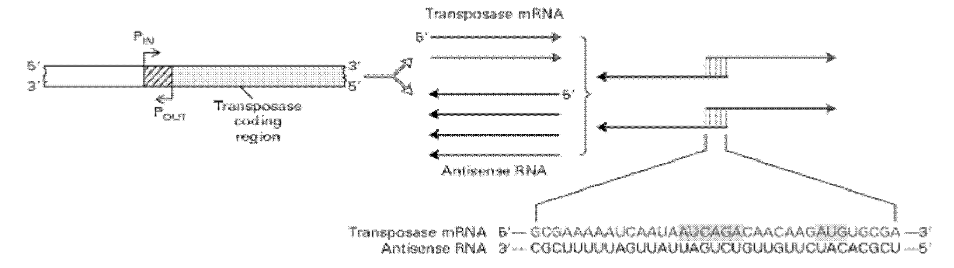
Antigen: A substance which, under certain conditions, is capable of inducing the formation of antibodies and reacting specifically with the antibodies in a detectable manner. It is usually

foreign and elicits production of and is specifically bound by an antibody.

Antiport: A type of cotransport in which a membrane protein (antiporter) transports two different molecules or ions across a cell membrane in opposite directions.

Antipyretic: A drug that lowers elevated body temperature.

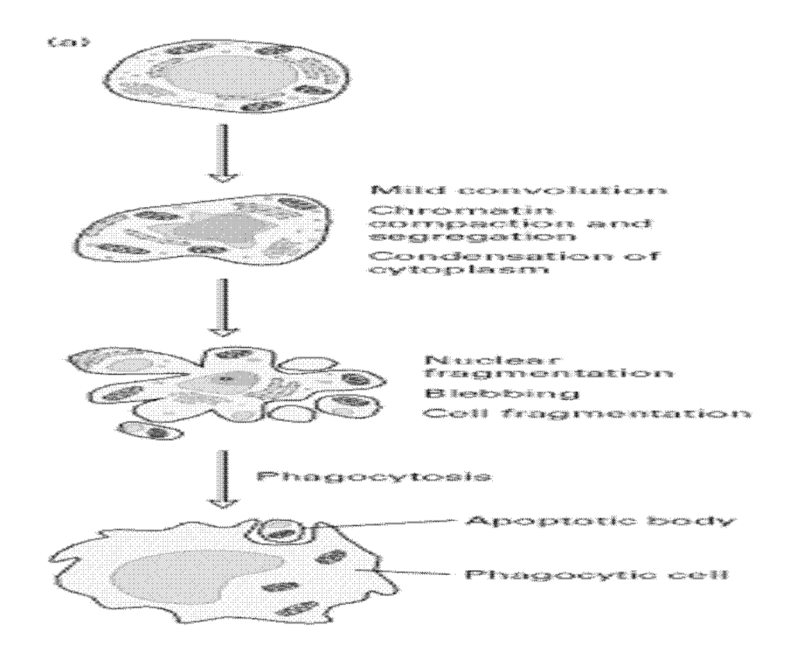
Antisense RNA: An RNA, with sequence complementary to a specific RNA transcript or mRNA, whose binding prevents processing of the transcript or translation of the mRNA.



Antiseptic: A drug or chemical that inhibits the growth of microorganisms without necessarily destroying them.

Apnea: A temporary cessation of breathing.

Apoptosis: Regulated process leading to cell death via a series of well-defined morphological changes; also called programmed cell death. See next figure:



Archaea: Class of prokaryotes that constitutes one of the three distinct evolutionary lineages of modern-day organisms; also called archaebacteria and archaeans. These prokaryotes are in some respects more similar to eukaryotes than to the so-called true bacteria (eubacteria).

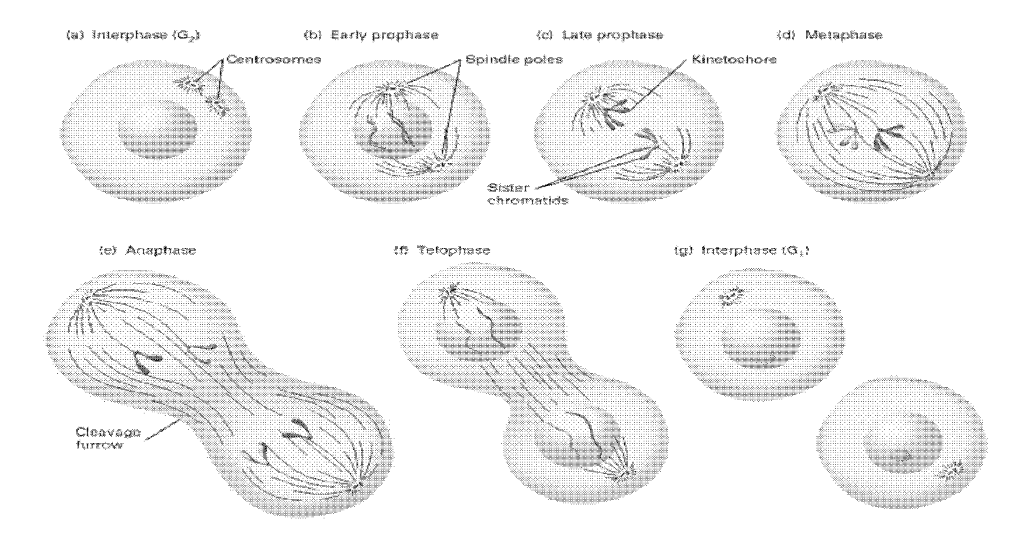
Articulation: The place of union or junction between two or more bones of the skeleton.

Aseptic: Clean; free of pathogenic organisms.

Asphyxiant: A relatively non-toxic gas that in high concentrations in the air results in insufficient oxygen which can cause hypoxia.

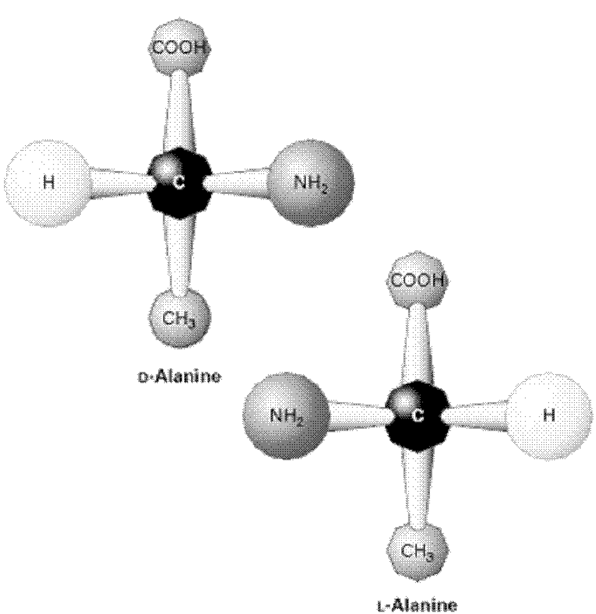
Association constant (Ka): See under: equilibrium constant.

Aster: Star-shaped structure composed of microtubules (called astral fibers) that radiates outward from a centrosome during mitosis. See the next figure:



Astringent: A drug or preparation that produces shrinkage of body membranes, especially mucous membranes.

Asymmetric carbon atom: A carbon atom bonded to four different atoms; also called chiral carbon atom. The bonds can be arranged in two different ways producing stereoisomers that are mirror images of each other. See next figure:



Asymptomatic: Having no symptoms.

ATP (adenosine 5′-triphosphate): A nucleotide that is the most important molecule for capturing and transferring free energy in cells. Hydrolysis of each of the two high-energy phosphoanhydride bonds in ATP is accompanied by a large free-energy change (ΔG) of −7 kcal/mole.

ATPase: One of a large group of enzymes that catalyze hydrolysis of ATP to yield ADP and inorganic phosphate with release of free energy.

ATP synthase: Multimeric protein complex bound to inner mitochondrial membranes, thylakoid membranes of chloroplasts, and the bacterial plasma membrane that catalyzes synthesis of ATP during oxidative

phosphorylation and photosynthesis; also called F0F1 complex.

ATSDR: Agency for Toxic Substances and Disease Registry. It is a federal agency responsible for emergency response to chemical spills and assessment of health effects of hazardous waste sites.

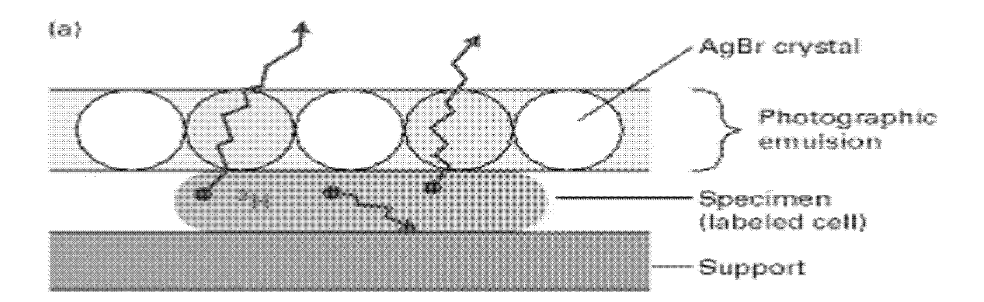
Auscultation: The act of listening for sounds within the body, with or without a stethoscope.

Autoimmunity: An immune response that recognizes the constituents of the body's own cells as foreign and thus induces hypersensitivity to its own tissues.

Autolysis: The spontaneous disintegration of tissues or cells by the action of their own serum or enzymes, such as occurs after death and in some pathological conditions.

Autonomously replicating sequence (ARS): Sequence that permits a DNA molecule to replicate in yeast; a yeast DNA replication origin.

Autoradiography: Technique for visualizing radioactive molecules in a sample (e.g., a tissue section or electrophoretic gel) by exposing a photographic film or emulsion to the sample. The exposed film is called an autoradiogram or autoradiograph. See figure:



Autosome: Any chromosome other than a sex chromosome.

Auxotroph: A mutant cell or microorganism that grows only when the medium contains a specific nutrient or metabolite that is not required by the wild type.

Average Daily Intake: The amount of a chemical to which a person consumes over a period of a day. It is determined by multiplying typical concentration of the chemical in drinking water, air, and food by an average daily intake factor

such as 2 liters of water per day.

Avulsed: A forcible separation; also, a part torn from another.

Axillary: Pertaining to the area of the armpit.

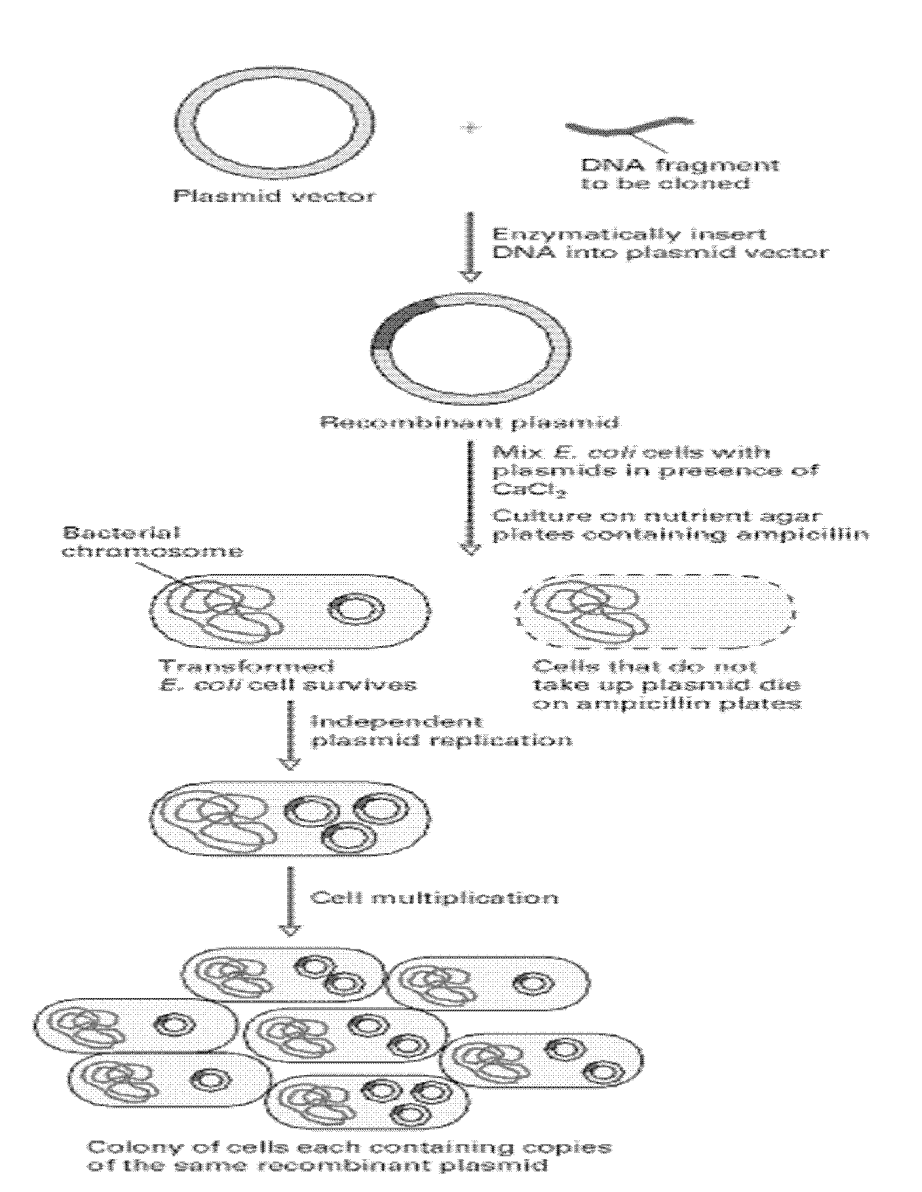
Axon: Long process extending from the cell body of a neuron that is capable of conducting an electric impulse (action potential) generated at the junction with the cell body (called the axon hillock) toward its distal, branching end (called the axon terminal).

Axoneme: Bundle of microtubules and associated proteins present in cilia and flagella and responsible for their movement. See this figure which demonstrates cellular motility

B

Bactericide: An agent that destroys bacteria.

Bacteriophage (phage): Any virus that infects bacterial cells. Some bacteriophages are widely used as cloning vectors. See next figure:


Plasmid vector
+
DNA fragment
to be cloned
Enzymatically insert
DNA into plasmid vector
Recombinant plasmid
Mix E. coli cells with
plasmids in presence of
$CaCl_2$
Culture on nutrient agar
plates containing ampicillin
Bacterial
chromosome
Transformed
E. coli cell survives
Cells that do not
take up plasmid die
on ampicillin plates
Independent
plasmid replication
Cell multiplication
Colony of cells each containing copies
of the same recombinant plasmid

Bacteriostatic: An agent that inhibits the growth of bacteria.

Basal body: Structure at the base of cilia and flagella from which microtubules forming the axoneme radiate; structurally similar to a centriole.

Basal lamina (pl. basal laminae): A thin sheetlike network of extracellular-matrix components that underlies most animal epithelial layers and other organized groups of cells (e.g., muscle), separating them from connective tissue.

Base: A compound, usually containing nitrogen, that can accept a proton (H+). Commonly used to denote the purines and pyrimidines in DNA and RNA.

Base pair: Association of two complementary nucleotides in a DNA or RNA molecule stabilized by hydrogen bonding between their base components. Adenine pairs with thymine or uracil (A·T, A·U) and guanine pairs with cytosine (G·C).

Benign: Referring to a tumor containing cells that closely resemble normal cells. Benign tumors stay in the tissue where they originate. It does not invade adjacent tissues or metastasize. It is generally treatable.

Beta (β) sheet : A planar secondary structure of proteins that is created by hydrogen bonding between the backbone atoms in two different polypeptide chains or segments of a single folded chain.

Bias: Systematic error that may be introduced in sampling by selecting or encouraging one outcome over another.

Bioaccumulation: The build-up of a substance in a biological organism such that the level in the organism is greater than in environmental source of the substance. It means also bioconcentration.

Bioactivation: The metabolic process whereby a parent substance is chemically changed to a daughter substance with enhanced biological activity.

Bioassay: A laboratory study used to determine the ability of a substance to produce a particular biological effect.

Bioavailability: The physical and/or biological state of a substance rendering it capable of being absorbed into the body.

Bioconcentration: Equals bioaccumulation.

Biodegradation: Breakdown of a chemical into smaller less complex molecules by microorganisms in environmental media (e.g., soil, water, sediment).

Biologicals: Medicinal preparations made from living organisms and their products, including serums, vaccines, antigens, and antitoxins.

Biological Half-Life: The time required to eliminate one-half the quantity of a substance from the body.

Biomarker: Indicators of events occurring in biologic systems due to a xenobiotic. The types of indicators are exposure, effects, or susceptibility.

Biomembrane: Permeability barrier, surrounding cells or organelles, that consists of a phospholipid bilayer, associated membrane proteins, and in some cases cholesterol and glycolipids.

Biotransformation: Conversion of a chemical from one form to another by a biological organism.

Blanching: Turning white.

Blastula: An early embryonic form produced by cleavage of a fertilized ovum and usually consisting of a single layer of cells surrounding a fluid-filled spherical cavity.

Bleb: Blister, bubble.

Body Burden: The concentration of a substance which has accumulated in the body.

Bone Marrow: The tissue within the internal open space of bones (e.g., shaft of long bones) in which the blood-forming elements exist.

Bradycardia: Abnormally slow heartbeat, evidenced by a pulse rate of 60 or less.

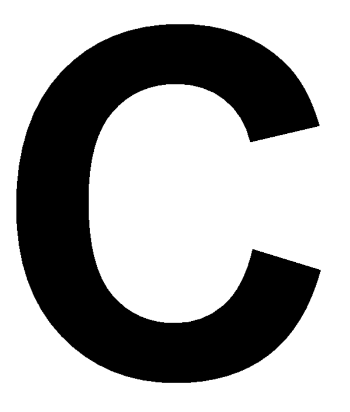
Bradypenia: Abnormally slow breathing.

Bronchioles: The very small branches of the tracheo-bronchial tree of the respiratory tract which terminate in the alveoli.

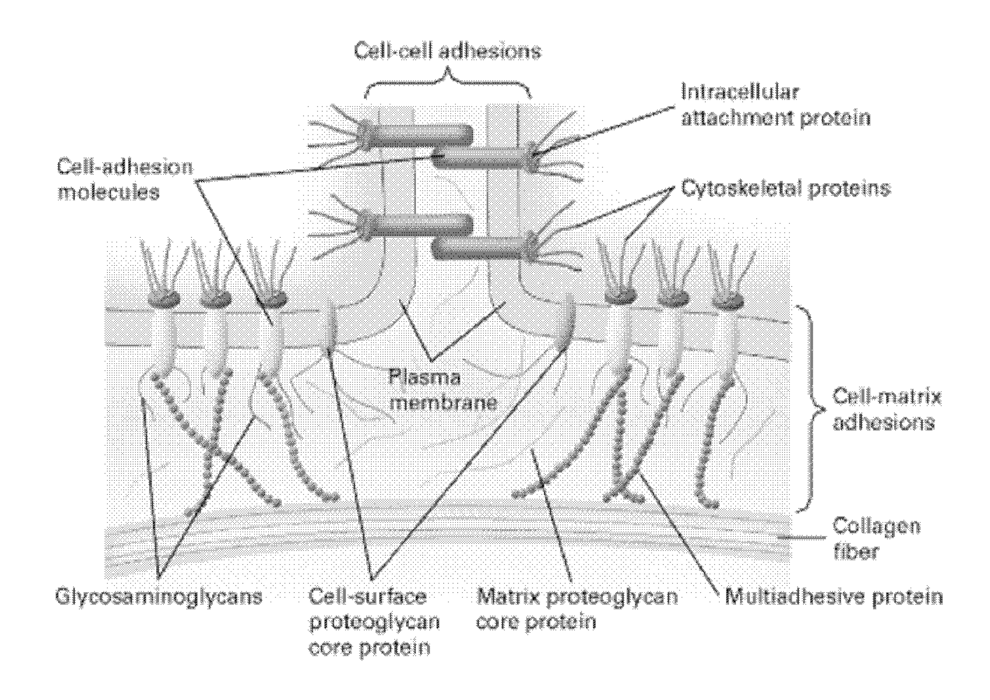
Bubo: An inflamed swelling of a lymphatic gland, especially in the area of the armpit or groin.

Buccal: Referring to the cheek.

Buffer: A solution of the acid (HA) and base (A^-) form of a compound that undergoes little change in pH when small quantities of strong acid or base are added.



Cadherin: Protein belonging to a family of Ca2-dependent cell-adhesion molecules that play roles in tissue differentiation and structure. This figure shows molecules that bind cells to each other and to extracellular matrix:



Calmodulin: A small cytosolic protein that binds four Ca2+ ions; the Ca2+-calmodulin complex binds to and activates many enzymes.

Calvin cycle: The major metabolic pathway that fixes CO2 into carbohydrates during photosynthesis; also called carbon fixation. It is indirectly dependent on light but can occur both in the dark and light.

CAMP-dependent protein kinase (cAPK): Type of cytosolic enzyme that is activated by cAMP and functions to regulate the activity of numerous cellular proteins; also called protein kinase A. Generally is activated in response to a rise in cAMP level resulting from stimulation of G protein-coupled receptors.

Cancer: an uncontrolled growth of abnormal cells, creating a tumor that can invade surrounding tissues and may spread (metastasis) to distant organs.

Cancer Slope Factor: A key risk assessment parameter derived by the EPA. It is an estimate of the probability that an individual will develop cancer if exposed to a specified amount of chemical (mg/kg) every day for a lifetime.

Capsid: The outer proteinaceous coat of a virus, formed by multiple copies of one or more protein subunits and enclosing the viral nucleic acid.

Carbohydrate: General term for certain polyhydroxyaldehydes, polyhydroxyketones, or compounds derived from these usually having the formula (CH_2O) n. Primary type of compound used for storing and supplying energy in animal cells.

Carbon fixation: As stated in Calvin cycle.

Carcinogen: Any chemical or physical agent that can cause cancer when cells or organisms are exposed to it.

Carcinogenic: The ability of a substance to cause cancer.

Carcinogenicity: The complex process whereby normal body cells are transformed to cancer cells.

Carcinoma: A malignant tumor derived from epithelial cells.

Carrier: A person or animal that harbors specific infectious agents in the absence of

discernible clinical disease, and serves as a potential source of infection for humans.

Case-Control Study: A type of epidemiology study to investigate the cause of the toxicity. It compares the exposure histories of humans who have a particular toxic effect with that of normal individuals.

Casts: Urinary sediments formed by coagulation of albuminous

Digestive processes are reduced to more simple substances.

Catabolism: Cellular processes whereby complex molecules are degraded to simpler ones and energy is released.

Catalyst: A substance that increases the rate of a chemical reaction without undergoing a permanent change in its structure. Enzymes are protein catalysts.

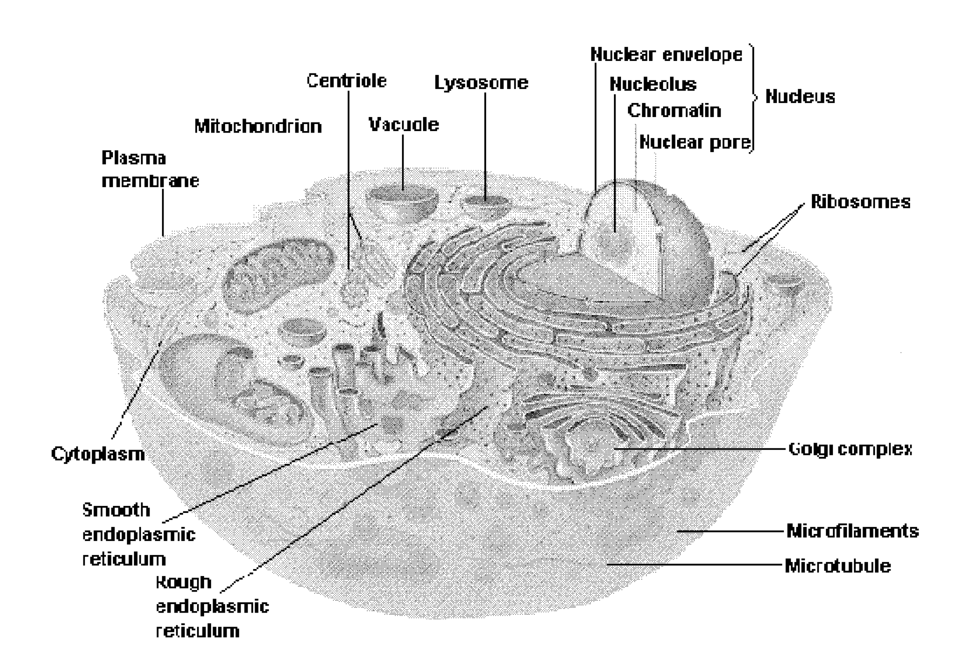
Catecholamines: Group of compounds derived from tyrosine that function as neurotransmitters; include epinephrine, norepinephrine, and dopamine.

Catharttics: Drugs that promote bowel movement.

CDNA (complementary DNA): DNA molecule copied from an mRNA molecule by reverse transcriptase and therefore lacking the introns present in genomic DNA. Sequencing of a cDNA permits the amino acid sequence of the encoded protein to be deduced; expression of cDNAs in recombinant cells can be used to produce large quantities of their encoded proteins in vitro.

Ceiling Level: The maximum allowable concentration of a chemical in the workplace for a specific period of time (usually 15 minutes).

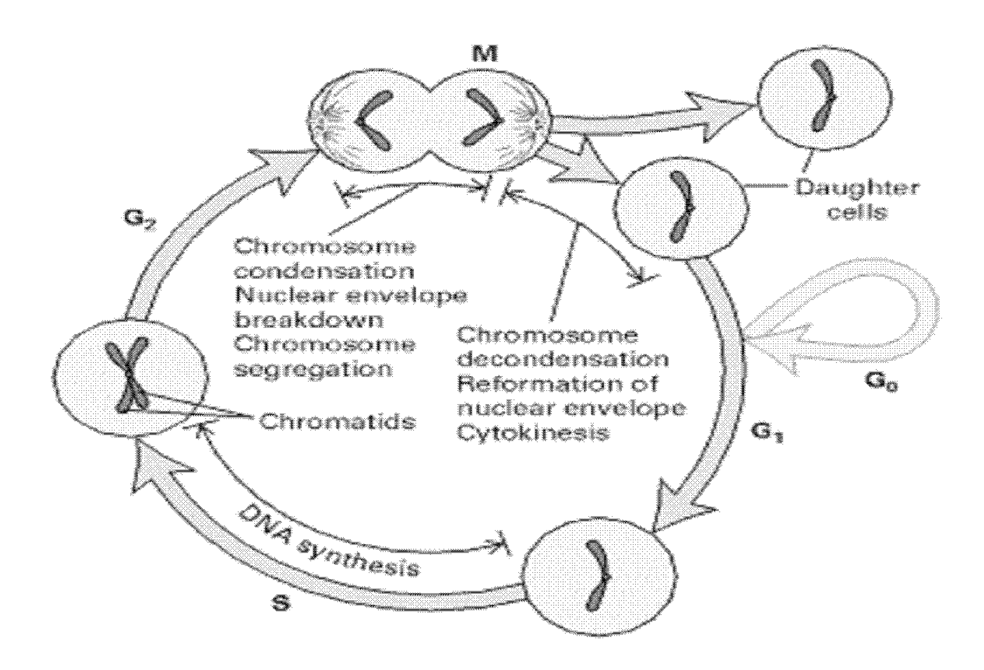
Cell: It is the smallest unit in the tissue, many tissues form an organ, many organs form a system, many systems form a whole body of the living creature (Eukaryote), while prokaryotes constitute mostly from a single cell. See cell structure of an eukaryotic cell:



Cell-adhesion molecules (CAMs): Integral membrane proteins that mediate cell-cell binding. The five major classes are the integrins, cadherins, selectins, immunoglobulin (Ig) superfamily, and mucins.

Cell cycle: Ordered sequence of events in which a cell duplicates its chromosomes and divides into two. Most eukaryotic cell cycles can be commonly divided into four phases: G1 before DNA synthesis occurs; S when DNA replication occurs; G2 after DNA synthesis; and M when cell division occurs, yielding two daughter cells. Under certain conditions, cells exit the cell cycle during G1 and remain in the G0 state as nongrowing, nondividing (quiescent) cells. Appropriate stimulation of such cells induces them to return to G1 and resume growth and division.

The next figure shows eukaryotic cell cycle :



Cell division: Separation of a cell into two daughter cells. In higher eukaryotes, it involves division of the nucleus (mitosis) and of the cytoplasm (cytokinesis); mitosis often is used to refer to both nuclear and cytoplasmic division.

Cell fusion: Production of a hybrid cell containing two or more nuclei by various techniques that stimulate the fusion of the plasma membranes of two cells at the point of contact and intermingling of their cytoplasms. See also hybridoma.

Cell junctions: Specialized regions on the cell surface through which cells are joined to each other or to the extracellular matrix.

Cell line: A population of cultured cells, of plant or animal origin, that has undergone a change allowing the cells to grow indefinitely, in contrast to a cell strain. Cell lines can result from chemical or viral transformation and are said to be immortal.

Cell strain: A population of cultured cells, of plant or animal origin, that has a finite life span, in contrast to a cell line.

Cell Transformation: The change of a cell from one form to another. The term is generally used to denote the change from normal to malignant.

Cellulose: A structural polysaccharide made of glucose units linked together by β(1n4) glycosidic bonds. It forms long microfibrils, which are the major component of plant cell walls.

Cell wall: A specialized, rigid extracellular matrix that lies next to the plasma membrane, protecting a cell and maintaining its shape. It is prominent in most fungi, plants, and prokaryotes, but is not present in most multicellular animals.

Central nervous system (CNS): The part of the vertebrate nervous system comprising the brain and spinal cord; the main information-processing organ.

Centriole: Either of two cylindrical structures within the centrosome of animal cells and containing nine sets of triplet microtubules; structurally similar to a basal body.

Centromere: Constricted portion of a mitotic chromosome where sister chromatids are attached and from which kinetochore fibers extend toward a spindle pole; required for proper chromosome segregation during mitosis and meiosis.

Centrosome (cell center) : Organelle located near the nucleus of animal cells that is the primary microtubule-organizing center (MTOC) and contains a pair of centrioles. It divides during mitosis, forming the spindle poles.

Cervical: Pertaining to the neck or the neck of any organ or structure.

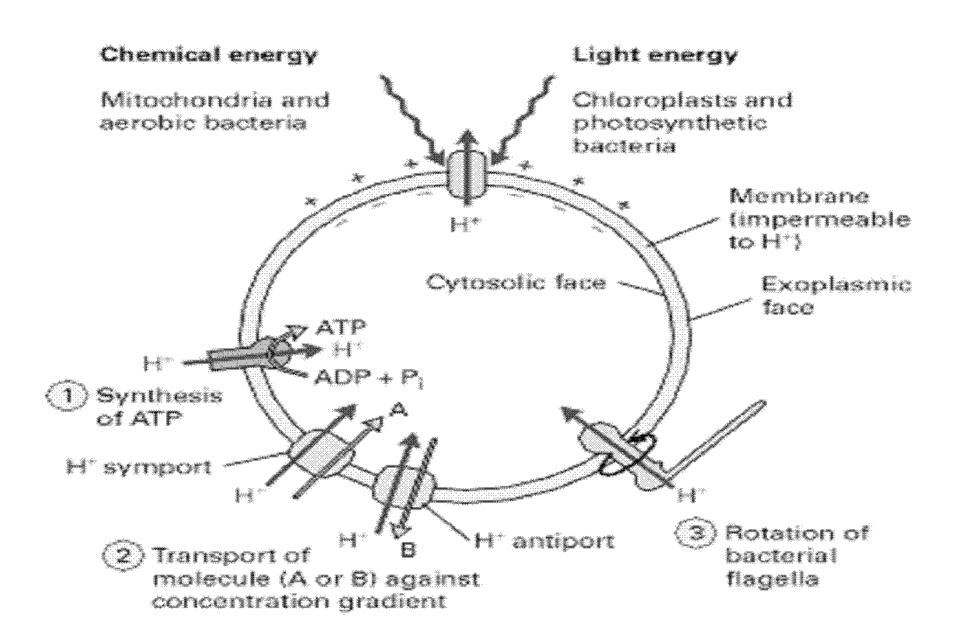
Chaperone: Collective term for two types of proteins that prevent misfolding of a target protein (molecular chaperones) or actively facilitate its proper folding (chaperonins).

Checkpoint: Any of several points in the eukaryotic cell cycle at which progression of a cell to the next stage can be halted until conditions are suitable.

Chemical equilibrium: The state of a chemical reaction in which the concentration of all products and reactants is constant and the rates of the forward and reverse reactions are equal.

Chemiosmosis : Process whereby an electrochemical proton gradient (pH plus electric potential) across a membrane is used to

drive an energy-requiring process such as ATP synthesis or transport of molecules across a membrane against their concentration gradient; also called chemiosmotic coupling. This is illustrated in that figure :



Cheyne - Stokes: Breathing characterized by alternating periods of apnea and deep respirations.

Chimera: An animal or tissue composed of elements derived from genetically distinct individuals; also a protein molecule containing segments derived from different proteins.

Chlorophylls: A group of light-absorbing porphyrin pigments those are critical in photosynthesis.

Chloroplast: A specialized organelle in plant cells that is surrounded by a double membrane and contains internal chlorophyll-containing membranes (thylakoids) where the light-absorbing reactions of photosynthesis occur.

Cholestasis: A liver condition in which excretion of bile salts via the bile duct is inhibited resulting in bile salts backing up into liver cells.

Cholesterol: An amphipathic lipid containing the four-ring steroid structure with a hydroxyl group on one ring; a major component of many eukaryotic membranes and precursor of steroid hormones.

Cholinergic Effect: Neurological effects resulting from the transmission by acetylcholine of impulses across synaptic junctions between nerves.

Chromatid: One copy of a duplicated chromosome, formed during the S phase of the cell cycle, that is still joined at the centromere to the other copy; also called sister chromatid. During mitosis, the two chromatids separate, each becoming a chromosome of one of the two daughter cells.

Chromatin: Complex of DNA, histones , and nonhistone proteins from which eukaryotic chromosomes are formed. Condensation of chromatin during mitosis yields the visible metaphase chromosomes.

Chromatography, liquid: Group of biochemical techniques for separating mixtures of molecules based on their mass (gel-filtration chromatography), charge (ion-exchange chromatography), or ability to bind specifically to other molecules (affinity chromatography). Commonly used technique for separating and purifying proteins. It is also an analytic method to separate and identify the components of a complex mixture by the differential movement through a two-phase system. The movement is effected by a flow of a liquid or a gas (mobile) phase, based on the physicochemical principles of adsorption, partition, ion exchange,

exclusion, or a combination of these principles.

Chromosome: In eukaryotes, the structural unit of the genetic material consisting of a single, linear double-stranded DNA molecule and associated proteins. During mitosis, chromosomes condense into compact structures visible in the light microscope. In prokaryotes, a single, circular double-stranded DNA molecule constitutes the bulk of the genetic material. See also karyotype.

Chromosome Aberration: Changes in chromosome structure.

Chronic Dose: Substance administered or received gradually over a long period of time (months to years).

Chronic Effect: An effect that either shows up a long time after an exposure (the latency period) or an effect that results from a long term (chronic) exposure.

Cilium (pl. cilia): Membrane-enclosed motile structure extending from the surface of eukaryotic cells. Cilia usually occur in groups and beat rhythmically to move a cell (e.g., single-celled organism) or to move small particles or fluid along the surface (e.g., trachea cells). See also axoneme and flagellum.

Cirrhosis: A chronic condition of the liver in which liver cells are replaced by fibrous cells.

Cis-acting: Referring to a regulatory sequence in DNA (e.g., enhancer, promoter) that can control a gene only on the same chromosome.

In bacteria, cis-acting elements are adjacent or proximal to the gene(s) they control, whereas in eukaryotes they may also be far away.

Cisterna (pl. cisternae) : Flattened membrane-bounded compartment, as found in the Golgi complex and endoplasmic reticulum.

Cistron: A genetic unit that encodes a single polypeptide.

Citric acid cycle : A set of nine coupled reactions occurring in the matrix of the mitochondrion in which acetyl groups derived from food molecules are oxidized, generating CO2 and reduced intermediates used to produce ATP; also called Krebs cycle and tricarboxylic acid cycle (TCA).

Clathrin: A fibrous protein that with the aid of assembly proteins polymerizes into a lattice-like network at specific regions on the cytosolic side of a membrane, thereby forming a clathrin-coated pit, which buds off to form a vesicle.

Clone: A population of identical cells or DNA molecules descended from a single progenitor. Also viruses or organisms that are genetically identical and descended from a single progenitor.

Cloning vector: An autonomously replicating genetic element used to carry a cDNA or fragment of genomic DNA into a host cell for the purpose of gene cloning. Commonly used vectors are bacterial plasmids and modified bacteriophage genomes.

CNS: The central nervous system consisting of the brain and spinal cord.

Coagulation: Clotting.

Coaptation: To fit together, as the edges of a wound or the ends of a fractured bone; category of splint.

Coccyx: Tailbone.

Codon: Sequence of three nucleotides in DNA or mRNA that specifies a particular amino acid during protein synthesis; also called triplet. Of the 64 possible codons, three are stop codons, which do not specify amino acids.

Coenzyme: Small organic molecule that associates with an enzyme and participates in the reaction catalyzed by the enzyme; also called cofactor. Some coenzymes form a transient covalent bond to the substrate; others function as carriers of electrons, acyl groups, or other activated groups. Generally, a coenzyme is bound less firmly to a protein than a prosthetic group.

Coenzyme A (CoA): See acetyl CoA.

An epidemiology study in Cohort Study : which a cohort (group) of individuals with exposure to a chemical and a cohort without exposure are followed over time to compare disease occurrence.

Coiled-coil: Stable rodlike quaternary protein structure formed by two or three α helices interacting with each other along their length; commonly found in fibrous proteins and certain transcription factors.

Colation: The process of straining or filtration.

Collagen: A triple-helical protein that forms fibrils of great tensile strength; a major component of the extracellular matrix and connective tissues. The numerous collagen subtypes differ in their tissue distribution and the extracellular components and cell-surface proteins with which they associate.

Communicable: Capable of being transmitted from one person to another.

Communicable Period : The period of time in which an infectious agent may be passed from an infected animal or man to a receptive host. There may be more than one such period of time during the course of disease.

Comminution: The process of physical reduction of a substance to fine particle size.

Complementary: Referring to two nucleic acid sequences or strands that can form a perfect base-paired double helix with each other; also describing regions on two interacting molecules (e.g., an enzyme and its substrate) that fit together in a lock-and-key fashion.

Complementary DNA (cDNA) : See cDNA.

Complementation: In genetics, the restoration of a wild-type function (e.g., ability to grow on galactose) in diploid heterozygotes generated from haploids, each of which carries a mutation in a different gene whose encoded protein is required for the same biochemical pathway. If two mutants with the same mutant phenotype (e.g., inability to grow on galactose) can complement each other, then their mutations are in different genes.

Conformation: The precise shape of a protein or other macromolecule in three dimensions resulting from the spatial location of the atoms in the molecule. A small change in the conformations of some proteins affects their activity considerably.

Conjugation: A metabolic process in which chemical groups are attached to foreign substances in the body, usually making the conjugated chemical more water soluble and easier to eliminate from the body.

Consensus sequence: The nucleotides or amino acids most commonly found at each position in the sequences of related DNAs, RNAs, or proteins.

Constitutive: Referring to cellular production of a molecule at a constant rate, which is not regulated by internal or external stimuli.

Constitutive mutant : (1) A mutant in which a protein is produced at a constant level, as if continuously induced; (2) a bacterial regulatory mutant in which an operon is transcribed in the

absence of inducer; (3) a mutant in which a regulated enzyme is in a continuously active form.

Contact: A person or animal known to have been associated with an infected person or animal, or a contaminated environment, and to have had the opportunity to acquire the infection.

Contamination: The presence of an infectious agent or toxin on the surface of a body or inanimate article, such as clothing, dishes, surgical dressings or instruments, as well as in food or water.

Contracture: A condition of muscle shortening and fibrous tissue development that results in a permanent joint deformity.

A group of animals or Control Group: humans in a study that are treated the same as the exposed groups but without receiving the specific exposure.

Contusion: A bruise.

Cooperativity: Property exhibited by some proteins with multiple ligand-binding sites whereby binding of one ligand molecule increases (positive cooperativity) or decreases (negative cooperativity) the binding affinity of successive ligand molecules.

Cornea: The transparent front surface of the eye.

Corrosion: Direct chemical action that results in irreversible damage at the site of contact. It is manifested by ulceration, necrosis, and scar formation.

Corrosive: A substance that rapidly destroys or decomposes body tissue at point of contact.

Cosmid: A type of vector used to clone large DNA fragments.

Cotransport: Protein-mediated transport of an ion or small molecule across a membrane against a concentration gradient driven by coupling to movement of a second molecule

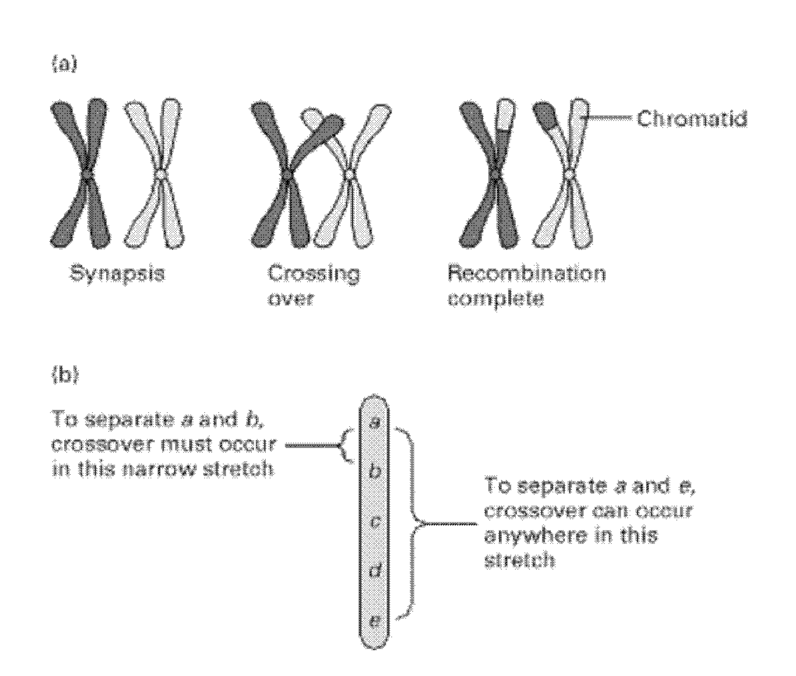
down its concentration gradient. See also antiport and symport.

Covalent bond: Stable chemical force that holds the atoms in molecules together by sharing of one or more pairs of electrons. Such a bond has strength of 50 - 200 kcal/mol. It is t he joining together of atoms that results from sharing electrons.

CPSC: Consumer Product Safety Commission. It is a federal agency responsible for protecting the public from toxins and other hazards present in consumer products.

Crepitus: The cracking or grating sound produced by fragments of fractured bones rubbing together.

Crossing over: Exchange of genetic material between maternal and paternal chromatids during meiosis to produce recombined chromosomes. The next figure shows recombination during meiosis:



Cross-Sectional Study: A type of epidemiology study that tests for the prevalence of a disease or clinical parameter among one or more exposed groups (e.g., the prevalence of respiratory conditions among furniture makers).

Cyclic AMP (cAMP): A second messenger, produced in response to hormonal stimulation of certain G protein - coupled receptors, that activates cAMP-dependent protein kinases , called adenylate cyclase , also, binding of certain ligands to their cell-surface receptors leads to activation of adenylyl cyclase and a rise in intracellular cAMP.

Cyclin: Any of several related proteins whose concentrations rise and fall during the course of the eukaryotic cell cycle. Cyclins form complexes with cyclin-dependent kinases,

thereby activating and determining the substrate specificity of these enzymes.

Cyclin-dependent kinase (Cdk): A protein kinase that is catalytically active only when bound to a cyclin. Various Cdk-cyclin complexes trigger progression through different stages of the eukaryotic cell cycle by phosphorylating specific target proteins.

Cytochromes : A group of colored, heme-containing proteins that transfer electrons during cellular respiration and photosynthesis.

Cytokine: Any of numerous secreted, small proteins (e.g., interferons, interleukins) that bind to cell-surface receptors on certain cells to trigger their differentiation or proliferation.

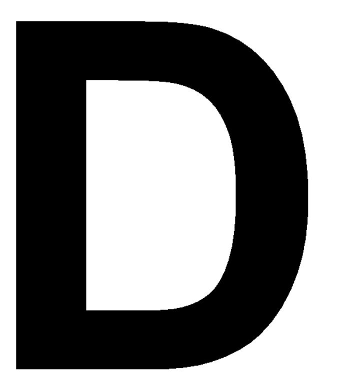
Cytokinesis: The last stage of mitosis, where the two daughter cells separate, each with a nucleus and cytoplasmic organelles.

Cytoplasm: Viscous contents of a cell that are contained within the plasma membrane but, in eukaryotic cells, outside the nucleus.

Cytoskeleton: Network of fibrous elements, consisting primarily of microtubules, actin microfilaments, and intermediate filaments, found in the cytoplasm of eukaryotic cells. The cytoskeleton provides structural support for the cell and permits directed movement of organelles, chromosomes, and the cell itself.

Cytosol: Unstructured aqueous phase of the cytoplasm excluding organelles, membranes, and insoluble cytoskeletal components.

Cytosolic face: The face of a cell membrane directed toward the cytoplasm.



Dalton: Unit of molecular mass approximately equal to the mass of a hydrogen atom (1.66 × 10^{-24} g).

Debility: The state of abnormal bodily weakness.

Debridement: The removal of all foreign matter and devitalized tissue in or about a wound.

Decantation: Separating liquids from solids by letting the solids settle to the bottom and pouring off the liquid.

Decerebrate: A person with brain damage that produces certain abnormal neurologic signs.

Decigram: 1/100th of a gram.

Decortication: Removing portions of the cortical substance of a structure or organ, such as the brain, kidney, or lung.

Decubitus Ulcer: Bed or pressure sore.

Degenerate: In reference to the genetic code, having more than one codon specifying a particular amino acid.

The loss of the myelin sheath Demyelination : (insulation) around a nerve.

Denaturation: Drastic alteration in the conformation of a protein or nucleic acid due to disruption of various noncovalent bonds caused by heating or exposure to certain chemicals; usually results in loss of biological function.

Dendrite: Process extending from the cell body of a neuron that is relatively short and typically branched and receives signals from axons of other neurons.)

Deoxyribonucleic acid: Means: DNA.

Depolarization: Change in the potential that normally exists across the plasma membrane of a cell at rest, resulting in a less negative membrane potential.

Dermal Sensitization Test: An assay for immune hypersensitivity of the skin.

Dermal Toxicity: Toxicity of the skin which can range from mild irritation to corrosivity, hypersensitivity, and skin cancer. It can result from direct contact or internal distribution of the xenobiotic to the skin.

Desmosomes : Specialized regions of the plasma membrane, consisting of dense protein plaques connected to intermediate filaments, that mediate adhesion between adjacent cells (especially epithelial cells) and between cells and the extracellular matrix.

Desquamate: To shed,peel, or scale off. AV-3.

Determination: In embryogenesis, a change in a cell that commits the cell to a particular developmental pathway.

Detoxification: A metabolic process whereby a parent substance is changed to a daughter product (metabolite) that has lessened toxicity.

Development: Overall process involving growth and differentiation by which a fertilized egg gives rise to an adult plant or animal, including the formation of individual cell types, tissues, and organs.

Diacylglycerol (DAG): Intracellular signaling molecule produced by cleavage of phosphoinositides in response to stimulation of certain cell-surface receptors; functions as a membrane-bound second messenger in inositol-lipid signaling pathways.

Diastole: The dilation or period of dilation of the heart, especially of the ventricles.

Diathermy: The generation of heat in tissue by electric current for medical or surgical purposes.

Differentiation: Process usually involving changes in gene expression by which a precursor cell becomes a distinct specialized cell type.

Diploid: Referring to an organism or cell having two full sets of homologous chromosomes and hence two copies (alleles) of each gene or genetic locus. Somatic cells contain the diploid number of chromosomes (2n) characteristic of a species.

Disaccharide: A small carbohydrate (sugar) composed of two monosaccharides covalently joined by a glycosidic bond. Common examples are lactose (milk sugar) and sucrose, a major photosynthetic product in higher plants.

Disinfection: The killing of infectious agents outside the body by physical or chemical means applied directly. Concurrent—done during the treatment of a patient with a communicable disease. Terminal— done after a patient has been discharged or transferred.

Disinfestation: A physical or chemical means of destroying animal or insect pests in a particular area.

Disposition: The term used to describe the kinetics of a substance in the body. It encompasses absorption, distribution, metabolism, and elimination of a chemical.

Dissociation constant (KD): Refer to equilibrium constant.

Distillation: Converting a liquid to a vapor by applying heat and condensing the vapor back to liquid by cooling.

Distribution: Movement of a substance from the site of entry to other parts of the body.

Disulfide bond (- S - S -): A common covalent linkage between the sulfhydryl groups on two cysteine residues in different proteins or in different parts of the same protein; generally found only in extracellular proteins or protein domains.

Diuresis: Urine excretion in excess of the usual amount.

Diuretics: Drugs that increase the secretion of urine.

DNA (deoxyribonucleic acid) : Long linear polymer, composed of four kinds of

deoxyribose nucleotides, that is the carrier of genetic information. In its native state, DNA is a double helix of two antiparallel strands held together by hydrogen bonds between complementary purine and pyrimidine bases.

DNA cloning : Recombinant DNA technique in which specific cDNAs or fragments of genomic DNA are inserted into a cloning vector, which then is incorporated into cultured host cells (e.g., E. coli cells) and maintained during growth of the host cells; also called gene cloning.

DNA library: Collection of cloned DNA molecules consisting of fragments of the entire genome (genomic library) or of DNA copies of all the mRNAs produced by a cell type (cDNA library) inserted into a suitable cloning vector.

DNA polymerase: An enzyme that copies one strand of DNA (the template strand) to make the complementary strand, forming a new double-stranded DNA molecule. All DNA polymerases add deoxyribonucleotides one at a time in the 5′n3′ direction to a short pre-existing primer strand of DNA or RNA.

Domain: Region of a protein with a distinct tertiary structure (e.g., globular or rod like) and characteristic activity; homologous domains may occur in different proteins.

Dominant: In genetics, referring to that allele of a gene expressed in the phenotype of a heterozygote; the nonexpressed allele is recessive. Also referring to the phenotype associated with a dominant allele.

Dominant Lethal Assay Test: A mutagenicity test that can detect heritable dominant lethal mutations present in the sperm as the result of exposure to a substance.

Dorsal: Relating to the back of an animal or the upper surface of a structure (e.g., leaf, wing).

Dosage: The determination of quantity of a substance received that incorporates the size, frequency, and duration of doses (e.g., 10 mg every 8 hours for 5 days).

Dose: The amount of a substance received at one time. Dose is usually expressed as administered or absorbed dose (e.g., milligrams material/kilogram of body weight).

Dose-Response Assessment: The relation between dose levels and associated effects.

Dose-Response Curve: A graphical representation of the quantitative relationship between doses of a substance and specific biological effects.

DOT: Department of Transportation. A federal agency responsible for the safe shipment of toxic chemicals and other hazardous materials.

Double helix, DNA: The most common three-dimensional structure for cellular DNA in which the two polynucleotide strands are anti-parallel and wound around each other with complementary bases hydrogen-bonded.

Downstream: For a gene, the direction RNA polymerase moves during transcription, which is toward the end of the template DNA strand with a 3′ hydroxyl group. By convention, the +1 position of a gene is the first transcribed nucleotide; nucleotides downstream from the +1 position are designated +2, +3, etc. Also, events that occur later in a cascade of steps. See also upstream.

Draize Test: The test for eye irritation in which the test substance is placed on the eyes of white rabbits and observed for 72 hours.

Drug Idiosyncrasy: An abnormal susceptibility or sensitivity to a drug.

Drug Tolerance: The unusual ability to endure, without effect, a quantity of a drug that would normally produce biological activity.

Dynein: Member of a family of ATP-powered motor proteins that move toward the (−) end of microtubules by sequentially breaking and forming new bonds with microtubule proteins. Dyneins can transport vesicles and are responsible for the movement of cilia and flagella.

Dyspnea: Labored or difficult breathing.

E

Ecchymosis: A small hemorrhagic spot, larger than a petechia, in the skin or mucous membrane, forming a non-elevated, rounded or irregular, blue

Or purplish patch.

Ecologic: A term referring to the general environment.

Ecotoxicity: The toxic effects on environmental organisms other than humans.

Ectoderm : Outermost of the three primary cell layers of the animal embryo; gives rise to epidermal tissues, the nervous system, and external sense organs.

ED50: Effective dose 50%. The estimated dose that causes some specific effect (usually desirable) for 50% of the population.

ED99: Effective dose 99%. The estimated dose that causes some specific effect (usually desirable) for 99% of the population.

Edema: The retention of fluid in an organ or in the body.

Effluent: The discharge of waste from a plant or other source into the environment.

Electron carrier: Any molecule or atom that accepts electrons from donor molecules and transfers them to acceptor molecules. Most are prosthetic groups (e.g., heme, copper, iron-

sulfur clusters) associated with membrane-bound proteins.

Electron transport: Flow of electrons via a series of electron carriers from reduced electron donors (e.g., NADH) to O2 in the inner mitochondrial membrane, or from H2O to NADP in the thylakoid membrane of plant chloroplasts.

Electrophoresis: Any of several techniques for separating macromolecules based on their migration in a gel or other medium subjected to a strong electric field.

Electrolyte: A substance that dissociates into ions in solution or when fused, thereby becoming capable of conducting electricity.

Electrophoretogram: An autoradiogram of a gel in which molecules have been separated by gel electrophoresis.

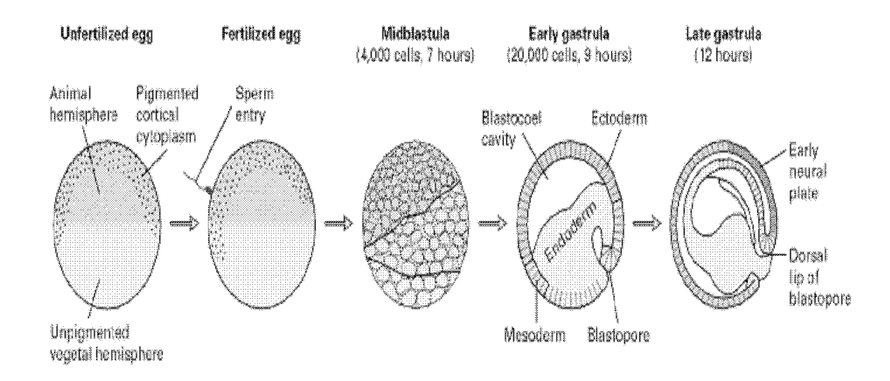
Elixir: An aromatic, sweetened, hydro alcoholic solution containing medicinal substances.

Elongation factor: One of a group of nonribosomal proteins required for continued translation of mRNA following initiation.

Embolus: A clot or other plug brought by the blood from another vessel and forced into a smaller one, thereby obstructing circulation.

Embryo: An early stage of the development of the unborn offspring in which cell differentiation proceeds rapidly along with the formation of the major organs. In humans this stage occurs from about 3 weeks until 8-9 weeks after conception.

Embryogenesis: Early development of an individual from a fertilized egg (zygote). Following cleavage of the zygote, the major axes are established during the blastula stage; in the subsequent gastrula stage, the early embryo invaginates and acquires three cell layers. The next figure shows that process:



Embryotoxic: The harmful effects of a substance on the developing embryo.

Emetic: A substance that causes vomiting.

Emollient: A drug that softens, soothes, or smooths the skin or irritated surfaces.

Emulsion: A liquid preparation containing two unmixable liquids, such as oil and water, one of which is dispersed as globules in the other.

Encapsulated: Enclosed within a capsule.

Endemic: The constant presence of a disease in a given locality.

Endocytosis: Uptake of extracellular materials by invagination of the plasma membrane to form a small membrane-bounded vesicle (early endosome).

Endoderm: Innermost of the three primary cell layers of the animal embryo; gives rise to the gut and most of the respiratory tract.

Endoplasmic reticulum (ER): Network of interconnected membranous structures within the cytoplasm of eukaryotic cells. The rough ER, which is associated with ribosomes, functions in the synthesis and processing of secretory and membrane proteins; the smooth ER, which lacks ribosomes, functions in lipid synthesis.

Endosome, late: A sorting vesicle with an acidic internal pH in which bound ligands dissociate from their membrane-bound receptor proteins. Late endosomes participate in sorting of lysosomal enzymes and in recycling of receptors endocytosed from the plasma membrane.

Endothelium: Layer of highly flattened cells that forms the lining of all blood vessels and regulates exchange of materials between the bloodstream and surrounding tissues; it usually is underlain by a basal lamina.

Endothermic: Referring to a chemical reaction that absorbs heat (i.e., has a positive change in enthalpy).

Enhancer: A regulatory sequence in eukaryotic DNA (rarely in prokaryotic DNA) that may be located at a great distance from the gene it controls. Binding of specific proteins to an enhancer modulates the rate of transcription of the associated gene.

Enteric: Of or within the intestine .

Enthalpy (H) : Heat; in a chemical reaction, the enthalpy of the reactants or products is equal to their total bond energies.

Entropy (S) : A measure of the degree of disorder or randomness in a system; the higher the entropy, the greater the disorder.

Environmental Fate: The fate of a substance following its release into the environment. It includes the movement and persistence of the substance.

Enzyme: A biological macromolecule that acts as a catalyst. Most enzymes are proteins, but certain RNAs, called ribozymes, also have catalytic activity for chemical reactions in cells.

Enzyme Activation: The increase in levels of an enzyme as the result of stimulation by another chemical substance.

Enzyme Inhibitor: A substance which causes a decrease in levels of an enzyme.

EPA: Environmental Protection Agency. A federal agency responsible for regulation of most chemicals that can enter the environment . The EPA administers the following acts: Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the Toxic Substances Control Act (TSCA), the Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act (SDWA), Clean Air Act (CAA), and the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) (Superfund Act) .

Epidemic: The outbreak of disease in a geographic area in excess of normal expectations.

Epidemiology: The study of the relative characteristics of exposed and nonexposed human populations for the purpose of detecting harmful effects.

Through the study of epidemics and epidemic diseases.

Epidermis: The outer layer of the skin.

Epinephrine: A catecholamine secreted by the adrenal gland and some neurons in response to stress; also called adrenaline. It functions as both a hormone and neurotransmitter, mediating "fight or flight" responses including increased blood glucose levels and heart rate.

Epithelium: Coherent sheet comprising one or more layers of cells that covers an external body surface or lines an internal cavity.

Epitope: The part of an antigen molecule that binds to an antibody; also called antigenic determinant.

Epistaxis: Nose bleed.

Epizootic: Attacking many animals in a region at the same time.

Equilibrium constant (K): Ratio of forward and reverse rate constants for a reaction. For a binding reaction, A + B 1 2 AB, it equals the association constant, Ka; the higher the Ka, the tighter the binding between A and B. The

reciprocal of the Ka is the dissociation constant, KD; the higher the KD, the weaker the binding between A and B.

Eradicate: Wipe out; destroy.

Erythema: Redness.

Erythrocyte: Red blood cell. AV-4.

Eubacteria: Class of prokaryotes that constitutes one of the three distinct evolutionary lineages of modern-day organisms; also called the true bacteria or simply bacteria. Phylogenetically distinct from archaea and eukaryotes.

Euchromatin: Less condensed portions of chromatin, including most transcribed regions, present in interphase chromosomes. See also heterochromatin.

Eukaryotes: Class of organisms, composed of one or more cells containing a membrane-enclosed nucleus and organelles, that constitutes one of the three distinct evolutionary lineages of modern-day organisms; also called eukarya. Includes all organisms except viruses and prokaryotes.

Eupnea: Ordinary, quiet breathing.

Eutaxia: The liquefaction of solids mixed in a dry state.

Exanguination: Extensive loss of blood due to hemorrhage, either internal or external.

Excretion: A process whereby substances (or metabolites) are eliminated from the body.

Exocytosis: Release of intracellular molecules (e.g., hormones, matrix proteins) contained within a membrane-bounded vesicle by fusion of the vesicle with the plasma membrane of a cell. This is the process whereby most molecules are secreted from eukaryotic cells.

Exon: Segments of a eukaryotic gene (or of its primary transcript) that reaches the cytoplasm as part of a mature mRNA, rRNA, or tRNA molecule. See also intron.

Exoplasmic face: The face of a cell membrane directed away from the cytoplasm. The exoplasmic face of the plasma membrane faces the cell exterior, whereas the exoplasmic face of organelles (e.g., mitochondria, chloroplasts, and the endoplasmic reticulum) face their lumen.

Exothermic: Referring to a chemical reaction that releases heat (i.e., has a negative change in enthalpy).

Exposure: Contact with a foreign substance, usually by inhalation, ingestion, or skin contact.

Exposure Assessment: The analysis or estimation of the intensity, frequency, and duration of human exposures to an agent.

Exposure Dose: The amount of a substance in the environment to which a person is subjected.

Expression: See gene expression.

Expression cloning: Recombinant DNA techniques for isolating a cDNA or genomic DNA segment based on functional properties of the encoded protein and without prior purification of the protein. Also refers to techniques for producing high levels of a full-length protein once its cDNA or gene has been cloned.

Expression vector: A modified plasmid or virus that carries a gene or cDNA into a suitable host cell and there directs synthesis of the encoded protein. Some expression vectors are designed

for screening DNA libraries for a gene of interest; others, for producing large amounts of a protein from its cloned gene.

Extension: Straightening or unbending, as in straightening the forearm, leg, or fingers.

Extracellular matrix: A usually insoluble network consisting of polysaccharides, fibrous proteins, and adhesive proteins that are secreted by animal cells. It provides structural support in tissues and can affect the development and biochemical functions of cells.

Extravasation: A discharge or escape, such as blood from a vessel into the tissue.

Extrication: The process of freeing a victim,

such as from a wrecked car or flooded compartment.

Extrinsic protein: See peripheral membrane protein.

F

F0 Generation: The initial parent generation in a multi-generation reproduction study.

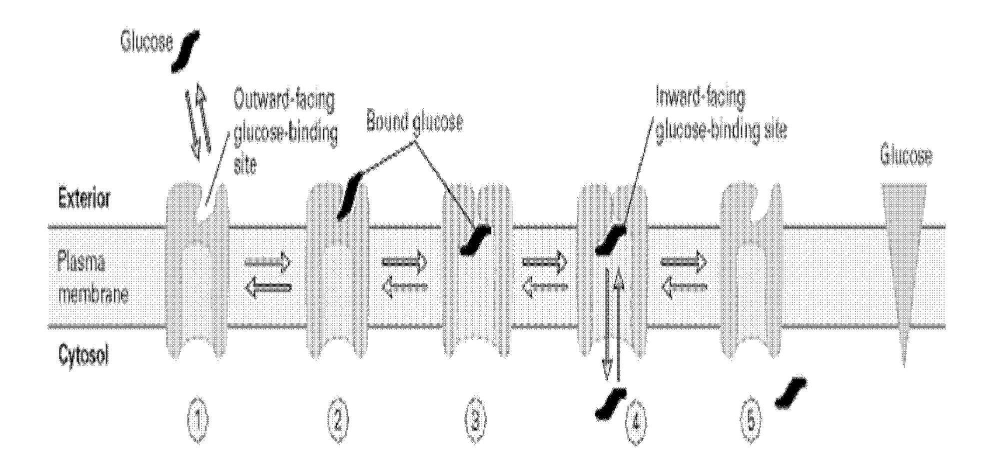
F0 F1 complex: See ATP synthase.

F1 Generation: The first filial generation (offspring) in a multi-generation reproduction study. It is produced by breeding individuals of the F0 generation.

F2 Generation: The second filial generation (offspring) in a multi-generation reproduction study. It is produced by breeding individuals of the F1 generation.

Facilitated transport: Protein-aided transport of an ion or molecule across a cell membrane down its concentration gradient at a rate greater

than that obtained by passive diffusion; also called facilitated diffusion. Such transport exhibits ligand specificity and saturation kinetics. The glucose transporter GLUT1 is a well studied example of a protein that mediates facilitated diffusion. See next figure:



FAD (flavin adenine dinucleotide): A coenzyme that participates in oxidation reactions by accepting two electrons from a donor molecule and two H+ from the solution. The reduced form, FADH2, transfers electrons to carriers that function in oxidative

phosphorylation.

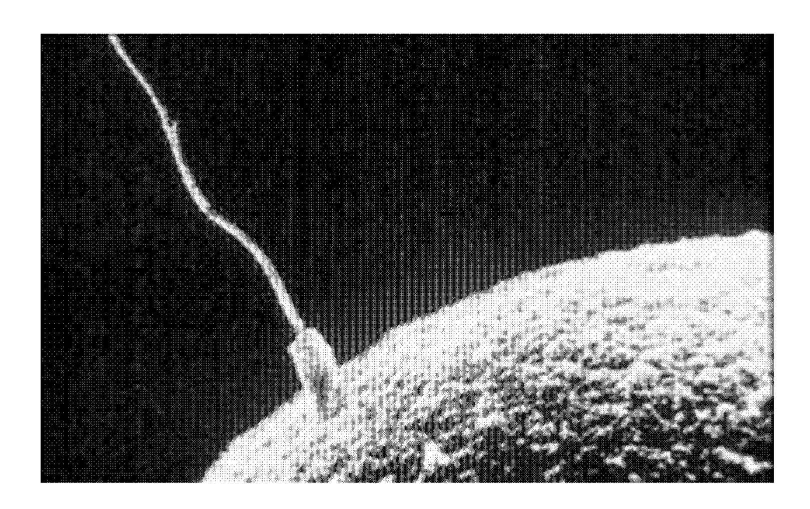
Fatty acid: Any hydrocarbon chain that has a carboxyl group at one end; a major source of energy during metabolism and precursors for synthesis of phospholipids.

FDA: Food and Drug Administration. A federal agency responsible for the safety evaluation of drugs, cosmetics, food additives, and medical devices.

Femtogram (fg): An extremely minute quantity, 1x10-15 gram.

Fertilization: Fusion of a female and male gamete (both haploid) to form a diploid zygote, which develops into a new individual. See next

Figure as sperm fertilizes an ovum:



Fetus: The unborn offspring in the postembryonic period, after major structures have been outlined. In humans this occurs from 8-9 weeks after conception until birth.

Fibroblast: A common type of connective-tissue cell that secretes collagen and other components of the extracellular matrix. It migrates and proliferates during wound healing and in tissue culture.

Fibronectin: An extracellular multiadhesive protein that binds to other matrix components, fibrin, and cell-surface receptors of the integrin family. It functions to attach cells to the extracellular matrix and is important in wound healing.

Fibrosis: The formation of scar tissue in an organ, generally by replacement of functional organ cells by non-functional fibrous tissue.

FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act. A federal law, administered by the EPA, to evaluate and register pesticides.

Flagellum (pl. flagella) : Long locomotory structure, extending from the surface of a eukaryotic cell, whose whiplike bending propels the cell forward or backward. Usually there is only one flagellum per cell (as in sperm cells). Bacterial flagella are smaller and much simpler structures.

Flexon: Bending, as in bending an arm or leg.

Fluorescein: See fluorescent staining.

Fluorescent staining: General technique for visualizing cellular components by treating cells with a fluorescent-labeled agent that binds specifically to a component of interest and then observing the cells by fluorescence microscopy. For instance, an antibody specific for a protein of interest can be chemically linked to a fluorescent dye such as fluorescein, which emits green light, or rhodamine, which emits red light. Various fluorescent dyes that bind specifically to DNA are used to detect chromosomes or specific chromosomal regions.

Fomite: An object, such as a book, wooden object, or an article of clothing, that is not in itself harmful, but is able to harbor pathogenic microorganisms and thus may serve as an agent of transmission of an infection.

Footprinting: Technique for identifying protein-binding regions of DNA or RNA. A radiolabeled nucleic acid sample is digested with a nuclease in the presence and absence of a specific binding protein. Because regions of DNA or RNA with bound protein are protected from digestion, the patterns of fragment bands separated by gel electrophoresis obtained from protected and unprotected samples differ, permitting identification of the protein-binding regions.

Free energy (G): A measure of the potential energy of a system, which is a function of the enthalpy (H) and entropy (S).

Free-energy change (ΔG): The difference in the free energy of the product molecules and of the starting molecules (reactants) in a chemical

reaction. A large negative value of ΔG indicates that a reaction has a strong tendency to occur; that is, at chemical equilibrium the concentration of products will be much greater than the concentration of reactants.

Fumigation: The destruction of disease-producing animals or insects by gaseous agents.

Fungicide: A drug that kills fungus.

Furuncle: An abscess in the true skin caused by the entry of microorganisms through a hair follicle or sweat gland.

Fusion: Melting.



G0, G1, G2 phase: Return to cell cycle.

Gamete: Specialized haploid cell (in animals either a sperm or an egg) produced by meiosis of germ cells; in sexual reproduction, union of a sperm and an egg initiates the development of a new individual.

Ganglion (pl. ganglia): Collection of neuron cell bodies located outside of the central nervous system.

Ganglioside: Any glycolipid containing one or more N-acetylneuraminic acid (sialic acid) residues in its structure. Gangliosides are found in the plasma membrane of eukaryotic cells and confer a net negative charge on most animal cells.

Gap junction: Protein-lined channel between adjacent cells that allows passage of ions and small molecules between the cells.

Gastrostomy: A surgical opening from the external surface of the body into the stomach, usually for inserting a feeding tube.

Gastrula: An early embryonic form subsequent to the blastula characterized by invagination of the cells to form a rudimentary gut cavity and development of three cell layers.

Gavage: Introducing a substance into the stomach through a tube.

Gene: Physical and functional unit of heredity, which carries information from one generation to the next. In molecular terms, it is the entire DNA sequence — including exons, Fertilization transcription-control regions — necessary for production of a functional protein or RNA. It is the smallest subunit of a chromosome that contains a genetic message. See also cistron and transcription unit.

Gene cloning: See DNA cloning.

Gene control: All of the mechanisms involved in regulating gene expression. Most common is regulation of transcription, although mechanisms influencing the processing, stabilization, and translation of mRNAs help control expression of some genes.

Gene conversion: Phenomenon in which one allele of a gene is converted to another during meiotic recombination.

Gene expression: Overall process by which the information encoded in a gene is converted into an observable phenotype (most commonly production of a protein).

Gene Mutation: A change in the DNA sequence within a gene.

Genetic code: The set of rules whereby nucleotide triplets (codons) in DNA or RNA specify amino acids in proteins. Next table shows amino acid coding:

Genetic Toxicity: Toxic effects that result from damage to DNA and altered genetic expression.

First Position (5' end)	Second Position				Third Position (3' end)
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	Stop (och)	Stop	A
	Leu	Ser	Stop (amb)	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu (Met)	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met (start)	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val (Met)	Ala	Glu	Gly	G

"Stop (och)" stands for the ochre termination triplet, and "Stop (amb)" for the amber, named after the bacterial strains in which they were identified. AUG is the most common initiator codon; GUG usually codes for valine, and CUG for leucine, but, rarely, these codons can also code for methionine to initiate an mRNA chain.

Genome: Total genetic information carried by a cell or organism.

Genomic DNA: All the DNA sequences composing the genome of a cell or organism.

Genomics: Comparative analysis of the complete genomic sequences from different organisms; used to assess evolutionary relations between species and to predict the number and general types of proteins produced by an organism.

Genotoxic: see genetic toxicity.

Genotype: Entire genetic constitution of an individual cell or organism; also, the alleles at one or more specific loci.

Germ cell: Any precursor cell that can give rise to gametes. i.e.: Reproductive cells which give rise to sperm or ova.

Germicide: An agent that kills germs.

Germ line: Lineage of germ cells, which give rise to gametes and thus participate in formation of the next generation of organisms; also the genetic material transmitted from one generation to the next through the gametes.

Gestation: The period of carrying developing offspring in the uterus after conception.

Glial cells: Nonexcitable supportive cells in the nervous system; also called neuroglial cells. Include astrocytes and oligodendrocytes in the vertebrate central nervous system and Schwann cells in the peripheral nervous system.

Glomerulus: The highly vascular structure in the kidney where much of the fluid portion of the blood (serum) is filtered and passes into the kidney tubules, carrying with it toxins and many other materials present in the serum.

Glucagon: A peptide hormone produced in the α cells of the pancreas that triggers the conversion of glycogen to glucose by the liver; acts with insulin to control blood glucose levels.

Glucose: Six-carbon monosaccharide (sugar) that is the primary metabolic fuel in most cells. The large glucose polymers, glycogen and starch, are used to store energy in animal cells and plant cells, respectively.

Glycocalyx: Carbohydrate-rich layer covering the outer surface of the plasma membrane of eukaryotic cells; composed of membrane glycolipids , the oligosaccharide side chains of integral membrane proteins, and absorbed peripheral membrane proteins.

Glycogen: A very long, branched polysaccharide, composed exclusively of glucose units, that is the primary storage carbohydrate in animal cells. It is found primarily in liver and muscle cells.

Glycogenolysis: Breakdown of glycogen to glucose 6-phosphate; stimulated by a rise in cAMP following epinephrine stimulation of cells and, in muscle, by a rise in Ca2+ following neuronal stimulation.

Glycolipid: Any lipid to which a short carbohydrate chain is covalently linked; commonly found in the plasma membrane.

Glycolysis: Metabolic pathway whereby sugars are degraded anaerobically to lactate or pyruvate in the cytosol with the production of ATP; also called Embden-Meyerhof pathway.

Glycoprotein: Any protein to which one or more oligosaccharide chains are covalently linked. Most secreted proteins and many membrane proteins are glycoproteins.

Glycosaminoglycan (GAG): A long, linear, highly charged polymer of a repeating disaccharide in which one member of the pair usually is a sugar acid (uronic acid) and the

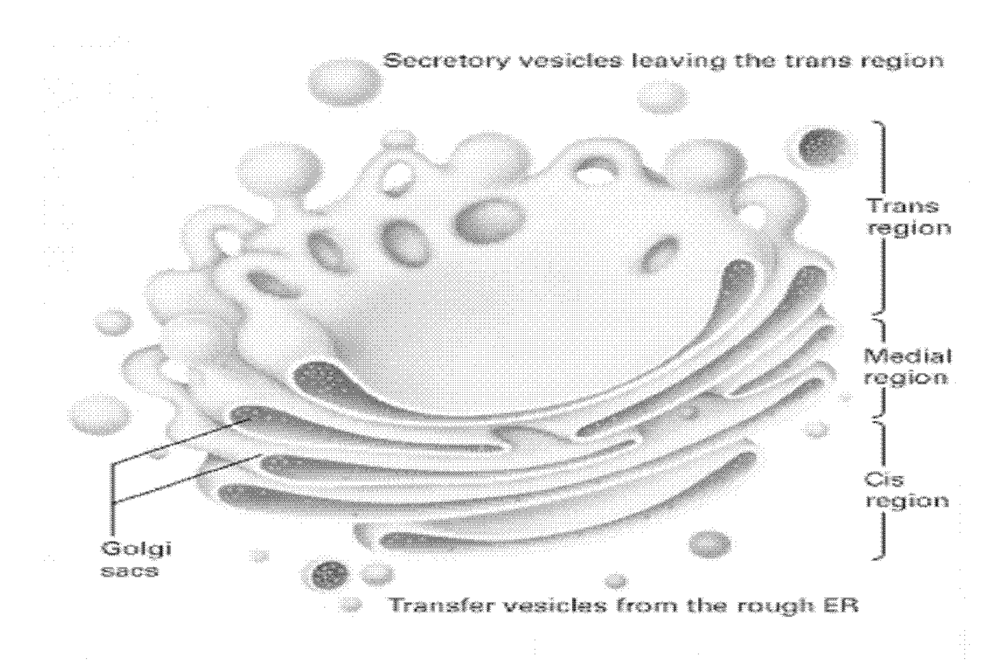
other is an amino sugar and many residues are sulfated. Generally are covalently bound to core proteins forming proteoglycans, which are major components of the extracellular matrix.

Glycosidic bond: The covalent linkage between two monosaccharide residues formed by a condensation reaction in which one carbon, usually carbon #1, of one sugar reacts with a hydroxyl group on a second sugar with the loss of a water molecule.

Glycosuria: Glucose in the urine.

Glycosyl transferase: An enzyme that forms a glycosidic bond between a sugar residue (monosaccharide) and an amino acid side chain of a protein or a residue in an existing carbohydrate chain.

Golgi complex: Stacks of membranous structures in eukaryotic cells that function in processing and sorting of proteins and lipids destined for other cellular compartments or for secretion; also called Golgi apparatus. It is seen as three dimensional figure as follows:



G protein: Any of numerous heterotrimeric GTP-binding proteins that function in intracellular signaling pathways; usually activated by ligand binding to a coupled seven-spanning receptor on the cell surface.

G protein-coupled receptor (GPCR): Member of an important class of cell-surface receptors that have seven transmembrane α helices and are directly coupled to a trimeric G protein.

Gram- Negative: A microorganism that does not retain Gram's crystal violet and is stained by the counterstain.

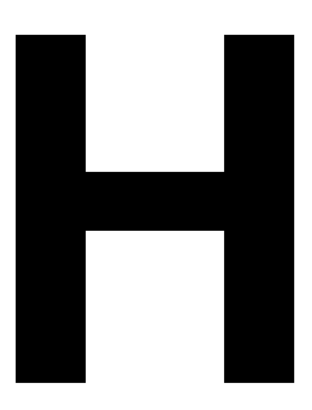
Gram-Positive: A microorganism that is stained by Gram's crystal violet.

Growth factor: An extracellular polypeptide molecule that binds to a cell-surface receptor triggering an intracellular signaling pathway leading to proliferation, differentiation, or other cellular response.

Growing fork: Site in double-stranded DNA at which the template strands are separated and addition of deoxyribonucleotides to each newly formed chain occurs; also called replication fork.

GTP (guanosine 5′-triphosphate): A nucleotide that is a precursor in RNA synthesis and also plays a special role in protein synthesis, signal-transduction pathways, and microtubule assembly.

GTPase superfamily: Group of GTP-binding proteins that cycle between an inactive state with bound GDP and an active state with bound GTP. These proteins including G proteins, Ras proteins, and certain polypeptide elongation factors function as intracellular switch proteins.



Haploid: Referring to an organism or cell having only one member of each pair of homologous chromosomes and hence only one copy (allele) of each gene or genetic locus. Gametes and bacterial cells are haploid. See also diploid.

Hazard: The inherit adverse effect of a substance.

An OSHA Hazard Communication Standard: standard established in 1983 requiring all employers to inform employees of the hazard of chemicals in the workplace and the steps necessary to avoid harm.

Hazard Identification: Characterization of the innate adverse toxic effects of an agent.

HeLa cell: Line of human epithelial cells, derived from a human cervical carcinoma, that grows readily in culture and is widely used in research.

Helicase: Any enzyme that moves along a DNA duplex using the energy released by ATP hydrolysis to separate (unwind) the two strands. Required for the replication and transcription of DNA.

Helix-loop-helix: A conserved structural motif found in many monomeric Ca2+-binding proteins and dimeric eukaryotic transcription factors.

Helix-turn-helix: A DNA-binding motif found in most bacterial DNA-binding proteins.

Hemacytometer: An instrument for estimating the number of blood cells in a measured volume of blood.

Hematemesis: Vomiting bright red blood.

Hematocrit: A determination of the volume percentage of red blood cells in whole blood.

Hemiplegia: Loss of motion and sensation of one side of the body.

Hemoglobin: Iron containing red pigment (heme) combined with a protein substance (globin).

Hemolysin: Substance that breaks down red blood cells, thereby liberating hemoglobin.

Hemoptysis: Coughing up bright red blood. AV-5.

Hemostatics: Drugs that control external bleeding by forming an artificial clot.

Hepatic Cancer: Cancer of the liver.

Hepatic Necrosis: Death of liver cells (hepatocytes).

Hepatitis: Inflammation of the liver .

Hepatotoxicity: Toxicity of the liver and associated bile duct and gall bladder.

Hepatotoxin: A systemic poison whose target organ is the liver.

Heritable Translocation Assay: A test for mutagenicity in which exposed male fruit flies (Drosophila) or mice are bred to non-exposed females. The offspring males (F1 generation) are then bred to detect the presence of chromosomal translocations indicating this specific type of mutation.

Heterochromatin: Regions of chromatin that remain highly condensed and transcriptionally inactive during interphase.

Heteroduplex: A double-stranded DNA molecule containing one or more mispaired bases.

Heterokaryon: Cell with more than one functional nucleus produced by the fusion of two or more different cells.

Heterozygous: Referring to a diploid cell or organism having two different alleles of a particular gene.

Hexose: A six-carbon monosaccharide.

High-energy bond: Covalent bond that releases a large amount of energy when hydrolyzed under the usual intracellular conditions. Examples include the phosphoanhydride bonds in ATP, thioester bond in acetyl CoA, and various phosphate ester bonds.

Histology: The microscopic study of tissue structure.

Histones: A family of small, highly conserved basic proteins, found in the chromatin of all eukaryotic cells, that associate with DNA in the nucleosome.

Holliday structure: Intermediate structure in recombination between homologous chromosomes.

Homeobox: Conserved DNA sequence that encodes a DNA binding domain (homeodomain) in a class of transcription factors encoded by certain homeotic genes.

Homeodomain: A conserved DNA-binding motif found in many developmentally important transcription factors. See also homeobox.

Homeosis: Transformation of one body part into another arising from mutation in or misexpression of certain developmentally critical genes.

Homeotic gene : A gene in which mutations cause cells in one region of the body to act as though they were located in another, giving rise to conversions of one cell, tissue, or body region into another.

Homologous chromosome: One of the two copies of each morphologic type of chromosome present in a diploid cell; also called homologue. Each homologue is derived from a different parent.

Homologue: See homologous chromosome.

Homology: Similarity in the sequence of a protein or nucleic acid or in the structure of an organ that reflects a common evolutionary origin. Molecules or sequences that exhibit homology are referred to as homologs. In contrast, analogy is a similarity in structure or function that does not reflect a common evolutionary origin.

Homozygous: Referring to a diploid cell or organism having two identical alleles of a particular gene.

Hormone: General term for any extracellular substance that induces specific responses in target cells. Hormones coordinate the growth, differentiation, and metabolic activities of various cells, tissues, and organs in multicellular organisms.

Host: A man or other living animal affording subsistence or lodgment to an infectious agent under natural conditions.

Hox complex: Clusters of homologous selector genes, which help determine the body plan in animals.

Human Dose Equivalent: A calculation of the dose in humans that produces a specific effect based on the dose that produces the effect in animals. A conversion formula comparing animal to human body weight or animal to human body surface is used.

Hyaluronan: A large, highly hydrated polysaccharide that is a major component of the extracellular matrix; also called hyaluronic acid and hyaluronate. It imparts stiffness and

resilience as well as a lubricating quality to many types of connective tissue.

Hybridization: Association of two complementary nucleic acid strands to form double-stranded molecules, which can contain two DNA strands, two RNA strands, or one DNA and one RNA strand. Used experimentally in various ways to detect specific DNA or RNA sequences.

Hybridoma: A clone of hybrid cells that are immortal and produce monoclonal antibodies; formed by fusion of normal antibody-producing B lymphocytes with myeloma cells.

Hydrogen bond: A noncovalent bond between an electronegative atom (commonly oxygen or nitrogen) and a hydrogen atom covalently bonded to another electronegative atom.

Particularly important in stabilizing the three-dimensional structure of proteins and formation of base pairs in nucleic acids.

Hydrolysis: Reaction in which a covalent bond is cleaved with addition of an H from water to one product of the cleavage and of an OH from water to the other.

Hydrophilic: Interacting effectively with water. See also polar.

Hydrophobic: Not interacting effectively with water; in general, poorly soluble or insoluble in water. See also nonpolar.

Hydrophobic bond: The force that drives nonpolar molecules or parts of molecules to associate with each other in aqueous solution. A type of noncovalent bond that is particularly

important in stabilization of the phospholipid bilayer.

Hydrotherapy: The scientific use of water in the treatment of disease.

Hyperglycemia: Abnormally increased content of sugar in the blood.

Hyperpnea: Increased rate and depth of breathing.

Hypersensitivity: A state of altered immune reactivity in which the body reacts with an exaggerated response to a foreign agent.

Hypertension: High blood pressure.

Hyperthermia: Abnormally high body temperature, especially that induced for therapeutic purposes.

Hypertonic: Referring to an external solution whose solute concentration is high enough to cause water to move out of cells due to osmosis.

Hypoglycemia: Low blood sugar.

Hypopnea: Abnormal shallowness and rapidity of breathing.

Hypostasis: Poor or stagnant circulation in a dependent part of the body or organ, as in venous insufficiency.

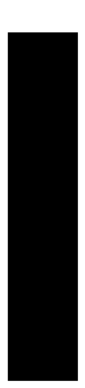
Hypotension: Low blood pressure.

Hypothermia: Abnormally low body temperature.

Hypotonic: Referring to an external solution whose solute concentration is low enough to cause water to move into cells due to osmosis.

Hypovolemia: Abnormally decreased volume of circulating fluid (plasma) in the body.

Hypoxia: Low oxygen content or tension; deficiency of oxygen in the inspired air. So , partial reduction in the oxygen concentration supplied to cells or tissues.



Idiosyncrasy: An abnormal sensitivity to some drug or other substance which is peculiar to the individual.

Immediately Dangerous to Life and IDLH : Health. A NIOSH estimate for the maximum level of exposure from which a person could exit in 30 minutes without escape-impairing symptoms or irreversible health effects.

Immiscible: Incapable of being mixed.

Immune person: An individual who does not develop clinical illness when exposed to specific infectious agents of a disease, due to the presence of specific antibodies or cellular immunity.

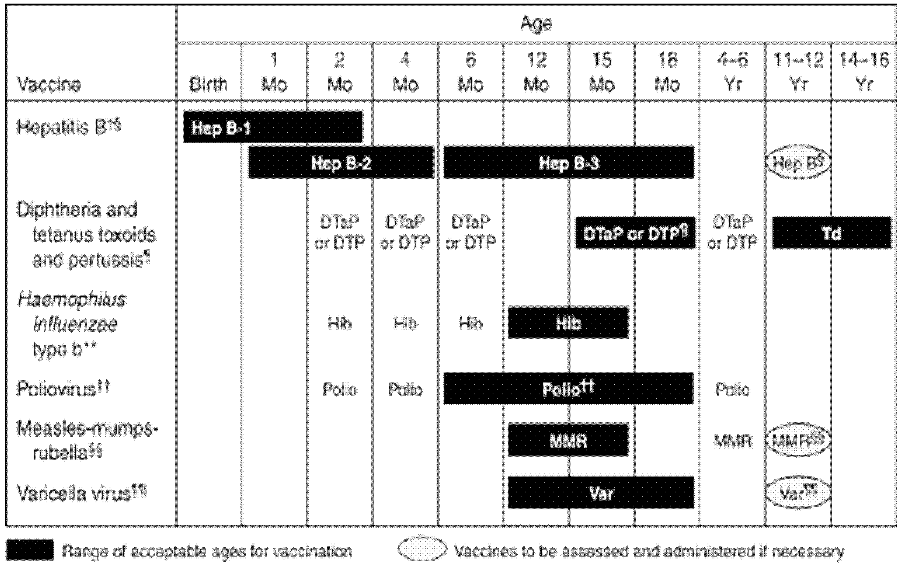
Immunity: A defense mechanism of the body which renders it resistant to certain organisms.

Immunization: Giving some attenuated microbes to help the immune system to produce specific antibodies to the given microbe, this immunity may last forever. See next Table for immunization schedules:

Recommended childhood immunization schedule

***--United States, January-December 1998.**

From American Academy of Pediatrics, Committee on Infectious Diseases: "Recommended Childhood Immunization Schedule--United States, January-December, 1998." Pediatrics 101:155-156, 1998.



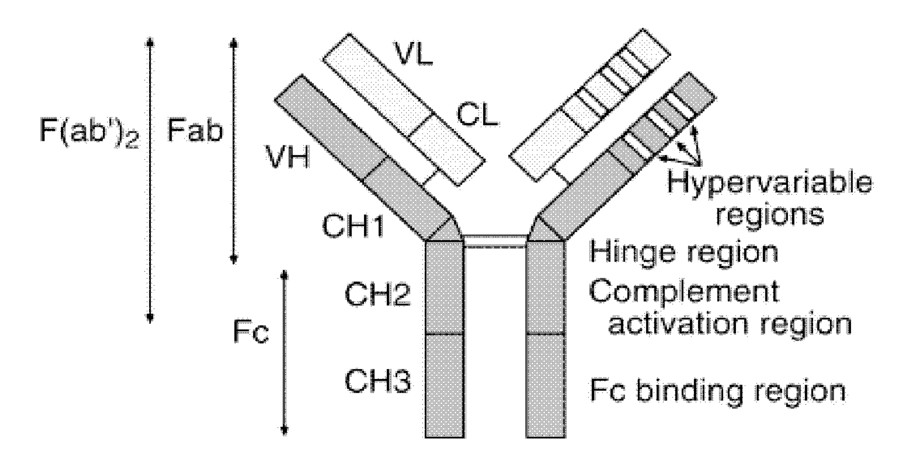
Vaccine	Age: Birth	1 Mo	2 Mo	4 Mo	6 Mo	12 Mo	15 Mo	18 Mo	4–6 Yr	11–12 Yr	14–16 Yr
Hepatitis B[†§]	Hep B-1	Hep B-1	Hep B-1								
		Hep B-2	Hep B-2	Hep B-2	Hep B-3	Hep B-3	Hep B-3	Hep B-3		(Hep B[§])	
Diphtheria and tetanus toxoids and pertussis[¶]			DTaP or DTP	DTaP or DTP	DTaP or DTP		DTaP or DTP[¶]	DTaP or DTP[¶]	DTaP or DTP	Td	Td
Haemophilus influenzae type b[**]			Hib	Hib	Hib	Hib	Hib				
Poliovirus[††]			Polio	Polio	Polio[††]	Polio[††]	Polio[††]	Polio[††]	Polio		
Measles-mumps-rubella[§§]						MMR	MMR		MMR	(MMR[§§])	
Varicella virus[¶¶]						Var	Var	Var		(Var[¶¶])	

■ Range of acceptable ages for vaccination ◯ Vaccines to be assessed and administered if necessary

This schedule indicates the recommended age for routine administration of currently licensed childhood vaccines; vaccines are listed under the ages for which they are routinely recommended. Catch-up immunization should be done during any visit when feasible. Some combination vaccines are available and may be used whenever administration of all components of the vaccine is indicated.

Providers should consult the manufacturers' package inserts for detailed recommendations.

Immunoglobulin (Ig) : Any protein that functions as an antibody. The five major classes of vertebrate immunoglobulins (IgA, IgD, IgE, IgG, and IgM) differ in their specific functions in the immune response. Next Figure is Ig G:



Immunotoxicity: Toxicity of the immune system. It may take several forms: hypersensitivity (allergy and autoimmunity), immunodeficiency, and uncontrolled proliferation (leukemia and lymphoma).

Inapparent Infection: An infection with no detectable clinical symptoms, even though the causative infectious agent may be identifiable with laboratory examinations. It is also known as an asypmtomatic or subclinical infection.

Incidence Rate: The number of specific disease cases diagnosed and reported in a specific population in a defined period of time. It is usually expressed as cases per 1,000 or 100,000 annually.

Incision: A cut, or a wound produced by cutting with a sharp instrument.

Incompatible: Not suitable for combination or simultaneous administration.

Incontinent: Unable to control excretory functions.

Incubation Period: The period of time between the initial exposure to an infectious agent and the first clinical symptoms of the disease.

Induction : In embryogenesis, a change in the developmental fate of one cell or tissue caused by direct interaction with another cell or tissue or with an extracellular signaling molecule; in metabolism, an increase in the synthesis of an enzyme or series of enzymes mediated by a specific molecule (inducer).

Induration: An abnormally hard spot or place

Infection: A condition resulting when pathogens enter body tissues, multiply, and cause injury to cells.

Infectious Agent: An organism capable of producing infection or disease.

Infectious Disease: A disease of man and animal resulting from an infection.

Infestation: The establishment and multiplication of small animals or arthropods (especially insects and rodents) on the body, clothing, or habitat of individuals or animals.

Inguinal: Pertaining to the abdomen, in the lower region.

Initiation factor: One of a group of proteins that promote the proper association of ribosomes and mRNA and are required for initiation of protein synthesis.

Initiator: A eukaryotic promoter sequence for RNA polymerase II that specifies transcription initiation within the sequence.

Insulin: A protein hormone produced in the β cells of the pancreas that stimulates uptake of glucose into muscle and fat cells and with glucagon helps to regulate blood glucose levels. Insulin also functions as a growth factor for many cells.

Integral membrane protein: Any membrane-bound protein all or part of which interacts with the hydrophobic core of the phospholipid bilayer and can be removed from the membrane only by extraction with detergent; also called intrinsic membrane protein.

Integrins: A large family of heterodimeric transmembrane proteins that promote adhesion of cells to the extracellular matrix or to the surface of other cells.

Interactions: Refers to measures of effects of simultaneous exposure to two or more substances. The four types of interactions are: additive, antagonistic, potentiation, or synergistic.

Interferons (IFNs): Small group of cytokines that bind to cell- surface receptors on target cells inducing changes in gene expression leading to an antiviral state or other cellular responses important in the immune response.

Intermediate filaments: Cytoskeletal fibers (10 nm in diameter) formed by polymerization of several classes of cell-specific subunit proteins including keratins, lamins, and vimentin. They constitute the major structural proteins of skin and hair; form the scaffold that holds Z disks and myofibrils in place in muscle; and generally function as important structural components of many animal cells and tissues.

Interphase: Long period of the cell cycle, including the G1, S, and G2 phases, between one M (mitotic) phase and the next.

Intrinsic protein: See integral membrane protein.

Intron: Part of a primary transcript (or the DNA encoding it) that is removed by splicing during RNA processing and is not included in the mature, functional mRNA, rRNA, or tRNA; also called intervening sequence.

Investigational New Drug Application (IND): Application submitted to the FDA by a pharmaceutical company requesting permission to undertake clinical investigations of a test drug in humans.

In vitro : Denoting a reaction or process taking place in an isolated cell-free extract; sometimes used to distinguish cells growing in culture from those in an organism. So, it is

outside a living organism (e.g., in a test tube).

In vivo: In an intact cell or living organism.
Ion channel: Any transmembrane protein complex that forms a water-filled channel across the phospholipid bilayer allowing selective ion transport down its electrochemical gradient. See also ion pump.

Ion pump: Any transmembrane ATPase that couples hydrolysis of ATP to the transport of a specific ion across the phospholipid bilayer against its electrochemical gradient.

Ionic bond: A noncovalent bond between a positively charged ion (cation) and negatively charged ion (anion).

Irritation: Local tissue reaction without involvement of an immunologic mechanism. It is a reversible inflammation.

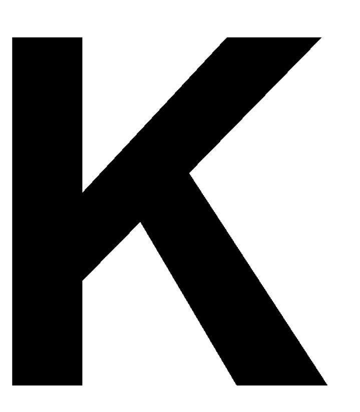
Isoelectric focusing: Technique for separating molecules by gel electrophoresis in a pH gradient subjected to an electric field. A protein migrates to the pH at which its overall net charge is zero.

Isoelectric point (pI): The pH of a solution at which a dissolved protein or other potentially charged molecule has a net charge of zero and therefore does not move in an electric field.

Isoform: One of several forms of the same protein whose amino acid sequences differ slightly but whose general activity is identical.

Isomer: A structurally different form of a chemical having the same molecular formula.

Isotonic: Referring to a solution whose solute concentration is such that it causes no net movement of water in or out of cells.



Karyotype: Number, sizes, and shapes of the entire set of metaphase chromosomes of a eukaryotic cell.

Keratolytic: Removes horny layers of epidermis.

Kinase: An enzyme that transfers the terminal (γ) phosphate group from ATP to a substrate. Protein kinases, which phosphorylate specific serine, threonine, or tyrosine residues in target proteins, play a critical role in regulating the activity of many cellular proteins. See also phosphatases.

Kinesin: Member of a family of motor proteins that use energy released by ATP hydrolysis to move toward the (+) end of a microtubule, transporting vesicles or particles in the

process.

Kinetochore: A three-layer protein structure located at or near the centromere of each mitotic chromosome from which microtubules (kinetochore fibers) extend toward the spindle poles of the cell; plays an active role in movement of chromosomes toward the poles during anaphase.

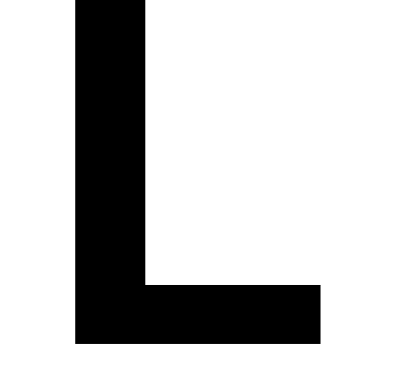
Km: A parameter that describes the affinity of an enzyme for its substrate and equals the substrate concentration that yields the half-maximal reaction rate; also called the Michaelis constant. A similar parameter describes the affinity of a transport protein for the transported molecule or the affinity of a receptor for its ligand.

Knockin, gene: Technique in which the coding sequences of one gene are replaced by those of another.

Knockout, gene: Technique for selectively inactivating a gene by replacing it with a mutant allele in an otherwise normal organism.

Krebs cycle: See citric acid cycle.

Kilogram (kg): A measure of weight consisting of 1000 grams (103 g).



Label: A fluorescent chemical group or radioactive atom incorporated into a molecule in order to spatially locate the molecule or follow it through a reaction or purification scheme. As a verb, to add such a group or atom to a cell or molecule.

Lacerated: Torn.

Laceration: A wound made by tearing and resulting in jagged edges.

Lacrimation: The secretion of tears .

Lacrimators: Tear gases.

Lactation: The production of milk.

Lagging strand: Newly synthesized DNA strand formed at the growing fork as short, discontinuous segments, called Okazaki fragments, which are later joined by DNA ligase. Although overall lagging-strand synthesis occurs in the 3′→5′ direction, each Okazaki fragment is synthesized in the 5′→3′ direction. See also leading strand.

Laminin: A component of the extracellular matrix that is found in all basal laminae and has binding sites for cell-surface receptors, collagen, and heparan sulfate proteoglycans.

Lamins: A group of intermediate filament proteins that form the fibrous network (nuclear lamina) on the inner surface of the nuclear envelope.

Latent: Concealed; not manifest; potential.

Lavage: The irrigation or washing out of an organ (such as the stomach or bowel).

Leading strand: Newly synthesized DNA strand formed by continuous synthesis in the 5′n3′ direction at the growing fork. The direction of leading-strand synthesis is the same as movement of the growing fork. See also lagging strand.

Lectin: Any protein that binds tightly to specific sugars. Lectins can be used in affinity chromatography to purify glycoproteins or as reagents to detect them in situ.

Leucine zipper: Common structural motif in some dimeric eukaryotic transcription factors characterized by a C-terminal coiled-coil dimerization domain and N-terminal DNA-binding domain.

Leukemia: Cancer of white blood cells and their precursors.

Llibrary: See DNA library.

Ligament: A sheet or band of tough, fibrous tissue connecting two or more bones or cartilages, or supporting an organ, fascia, or muscle. AV-7.

Ligand: Any molecule, other than an enzyme substrate, that binds tightly and specifically to a macromolecule, usually a protein, forming a

macromolecule-ligand complex.

Ligase: An enzyme that links together the 3′ end of one nucleic acid strand with the 5′ end of another, forming a continuous strand.

Liniment: Solution or mixture of various substances in oily, alcoholic, or emulsified form, intended for external application.

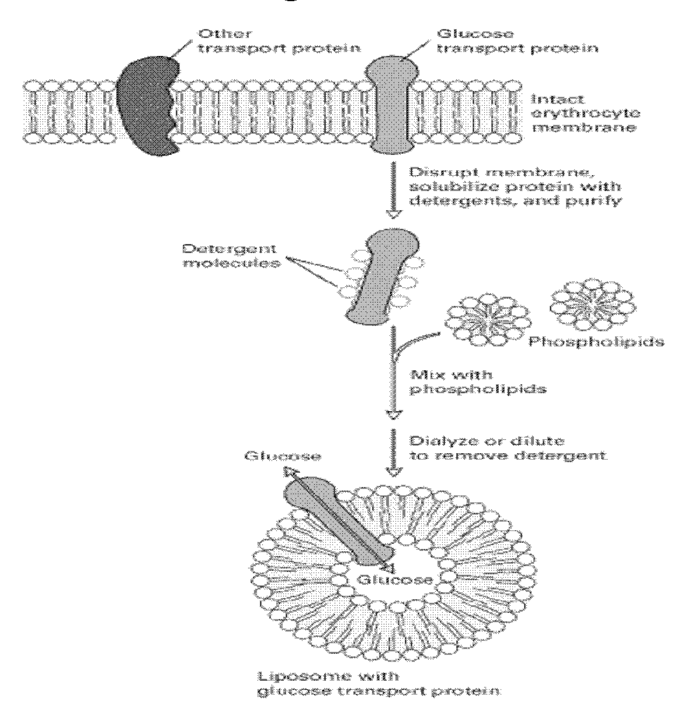
Linkage: In genetics, the tendency of two different loci on the same chromosome to be inherited together. The closer two loci are, the greater their linkage and the lower the frequency of recombination between them.

Lipid: Any organic molecule that is insoluble in water but is soluble in nonpolar organic solvents. Lipids contain covalently linked fatty

acids and are found in fat droplets and, as phospholipids, in biomembranes.

Lipophilic: See hydrophobic.

Liposome: Spherical phospholipid bilayer structure with an aqueous interior that forms in vitro from phospholipids and may contain protein. See next figure:



Locus: In genetics, the specific site of a gene on a chromosome. All the alleles of a particular gene occupy the same locus.

Lumbar: Pertaining to the part of the back between the thorax and the pelvis.

Lymphocytes: Two classes of white blood cells that can recognize foreign molecules (antigens) and mediate immune responses. B lymphocytes are responsible for production of antibodies; T lymphocytes are responsible for destroying virus- and bacteria-infected cells, foreign cells, and cancer cells.

Lyophilization: The creation of a stable preparation of a biological substance (blood plasma, serum, etc.) by rapid freezing and dehydration of the frozen product under high

vacuum.

Lysogenic cycle: Series of events in which a bacterial virus (bacteriophage) enters a host cell and its DNA is incorporated into the host-cell genome in such a way that the virus (the prophage) lays dormant. The association of a prophage with the host-cell genome is called lysogeny. By various mechanisms, the prophage can be activated so that it enters the lytic cycle.

Lysogeny : See lysogenic cycle.

Lysosome : Small organelle having an internal pH of 4-5 and containing hydrolytic enzymes.

Latency Period: The period of time between an exposure and onset of toxicity.

Lethal Concentration 0% The LC0 : calculated concentration of a gas at which none of the population is expected to die.

LC10: Lethal Concentration 10%. The calculated concentration of a gas at which 10% of the population is expected to die.

LC50: Lethal Concentration 50%. The calculated concentration of a gas at which 50% of the population is expected to die.

LC90: Lethal Concentration 90%. The calculated concentration of a gas at which 90% of the population is expected to die.

LD0: Lethal Dose 0%. The estimated dose at which none of the population is expected to die.

LD10: Lethal Dose 10%. The estimated dose at which 10% of the population is expected to die.

LD50: Lethal Dose 50%. The estimated dose at which 50% of the population is expected to die.

LD90: Lethal Dose 90%. The estimated dose at which 90% of the population is expected to die.

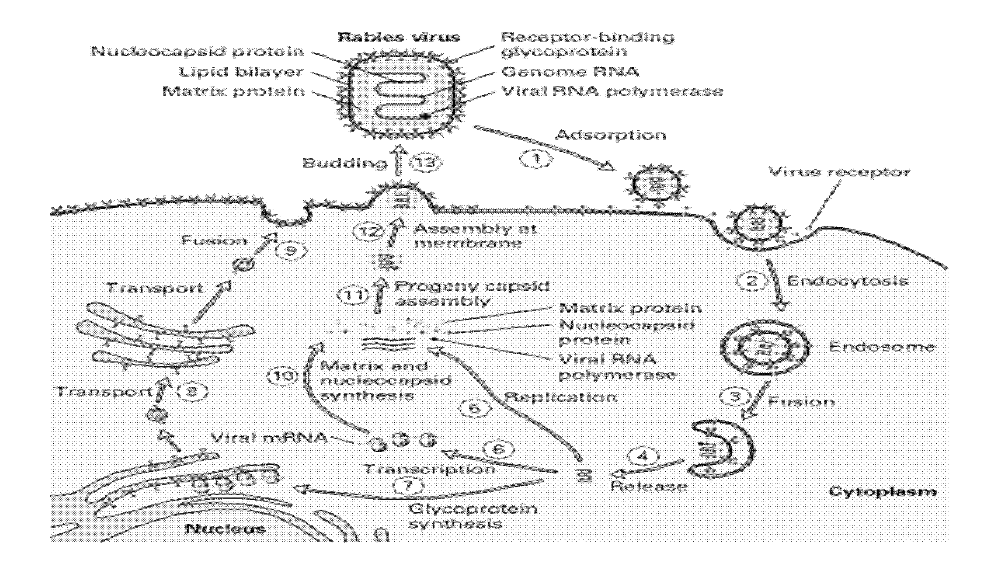
Linearized Multistage Model: A conservativequantitative cancer assessment model used by the EPA. It assumes linear extrapolation with a zero dose threshold from the upper confidence level of the lowest dose that produced cancer in an animal test or in a human epidemiology study.

Lipid Soluble: Capable of being dissolved in fat or in solvents that dissolve fat. Usually non-ionized compounds.

LOAEL: Lowest Observed Adverse Effect Level. The lowest dose in a study in which there was an observed toxic or adverse effect.

Lytic cycle: Series of events in which a virus enters and replicates within a host cell to

produce new viral particles eventually causing lysis of the cell. See also lysogenic cycle. See Figure:



M

MAC: Maximum Allowable Concentration. A recommendation for the highest level for long-term exposure to a chemical which will not produce adverse effect.

Maceration: Softening of a solid by soaking.

Macromolecule: Any large, usually polymeric molecule (e.g., a protein, nucleic acid, polysaccharide) with a molecular mass greater than a few thousand daltons.

Magmas: Thick, creamy, aqueous suspensions of inorganic substances in a very fine state.

Malaise: A vague feeling of bodily discomfort.

Malignant: Referring to a tumor or tumor cells that can invade surrounding normal tissue and/or undergo metastasis. See also benign.

Malignant Cell: A cancer cell that has the potential to invade surrounding tissues or spread to other areas of the body (metastasis).

Malignant Tumor: A tumor that can invade surrounding tissues or metastasize to distant sites resulting in life-threatening consequences.

MAP kinase: Protein kinase that is activated in response to cell stimulation by many different growth factors and that mediates cellular responses by phosphorylating specific target proteins.

Mapping: Various techniques for determining the relative order of genes on a chromosome (genetic map), the absolute position of genes (physical map), or the relative position of restriction sites (restriction map).

The ratio of the Margin of Safety (MOS) : dose that is just within the lethal range (LD01) to the dose that is 99% effective (ED99), LD01/ED99. A ratio of greater than 1 gives comfort to the physician whereas an a ratio of less than 1 denotes caution.

Mastication: Chewing.

Mechanism of Action: The specific manner by which a substance causes a particular effect.

Median Toxic Dose: The dose level at which

50% of the population will experience toxic effects.

Medical Aseptic Technique: The practice that prevents the spread of pathogens from person to person, place to place, or place to person.

Meiosis: In eukaryotes, a special type of cell division that occurs during maturation of germ cells; comprises two successive nuclear and cellular divisions with only one round of DNA replication resulting in production of four genetically nonequivalent haploid cells (gametes) from an initial diploid cell.

Melena: Excretion of black tarry stools.

Membrane: See biomembrane.
Membrane potential: Voltage difference across a membrane due to the slight excess of positive ions (cations) on one side and negative ions (anions) on the other.

Mesenchyme: Embryonic mesoderm tissue in animals from which are formed the connective tissues, blood vessels, and lymphatic vessels.

Mesoderm : The middle of the three primary cell layers of the animal embryo, lying between the ectoderm and endoderm; gives rise to the notochord, connective tissue, muscle, blood, and other tissues.

Messenger RNA: See mRNA.

Metabolism: The sum of all the physical and chemical processes by which living organized

substance is produced and maintained. Also, the transformation by which energy is made available to the organism. It includes anabolism and catabolism. It also means : the conversion of a chemical from one form to another. same as Biotransformation.

Metabolite: A chemical produced when a substance is metabolized by a biological organism.

Metamorphosis: Change of shape or structure, particularly a transition from one development stage to another, as from larva to adult form.

Metaphase: Mitotic stage at which chromosomes are fully condensed and attached to the mitotic spindle at its equator but have not

yet started to segregate toward the opposite spindle poles.

Metastasis: The movement of diseased cells, in particular cancer cells, from the site of origin to another location in the body. It is the spread of tumor cells from their site of origin and establishment of areas of secondary growth.

Metrology: The science of weights and measures.

Mg/kg: A commonly used dose that stands for mg of a substance per kg of body weight.

Mg/kg/day: A commonly used dosage that stands for mg of a substance per kg of body weight on a daily basis.

Mg/M3: an exposure unit used to express concentrations of particulates in the air, standing for milligrams of compound per cubic meter of air.

Michaelis Constant: See Km.

Microfilaments : Cytoskeletal fibers (7 nm in diameter) that are formed by polymerization of monomeric globular (G) actin; also called actin filaments. Microfilaments play an important role in muscle contraction, cytokinesis, cell movement, and other cellular functions and structures.

Microgram (µg): A commonly used unit of weight consisting of one millionth (1 x 10-6) of a gram.

Micronucleus Test: A test for mutagenicity in which bone marrow or peripheral blood cells are examined for the presence of micronuclei (broken pieces of chromosomes surrounded by a nuclear membrane).

Microorganism: A minute, living organism invisible to the naked eye.

Microtubules: Cytoskeletal fibers (24 nm in diameter) that are formed by polymerization of α,β-tubulin monomers and exhibit structural and functional polarity. They are important components of cilia, flagella, the mitotic spindle, and other cellular structures.

Microtubule-associated protein (MAP): Any protein, including motor proteins, that binds to microtubules in a constant ratio and determines

the unique properties of different types of microtubules.

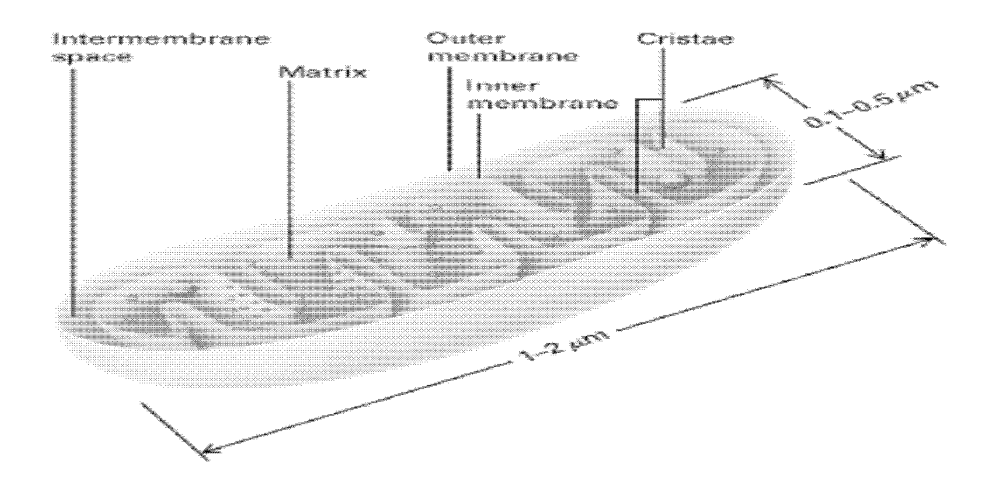
Microvillus (pl. microvilli): Small, membrane-covered projection on the surface of an animal cell containing a core of actin filaments. Numerous microvilli are present on the absorptive surface of intestinal epithelial cells, increasing the surface area for transport of nutrients.

Micturation: Voiding; urination.

Milligram (mg): The most commonly used unit of measure in medicine and toxicity consisting of one thousandth of a gram (1x10-3 g).

Minimal Risk Levels (MRL's): A risk level calculated by the ATSDR for noncancer end points. The MRL is an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects over a specified duration of exposure. MRL's are derived for acute (14 days or less), intermediate (15-364 days), and chronic (365 days or more) duration exposures for either inhalation or oral routes..

Mitochondrion (pl. mitochondria): Large organelle that is surrounded by two phospholipid bilayer membranes, contains DNA, and carries out oxidative phosphorylation, thereby producing most of the ATP in eukaryotic cells. See next Figure:



Mitogen: Any extracellular substance, such as a growth factor, that promotes cell proliferation.

Mitosis: In eukaryotic cells, the process whereby the nucleus is divided to produce two genetically equivalent daughter nuclei with the diploid number of chromosomes. See also cytokinesis and meiosis.

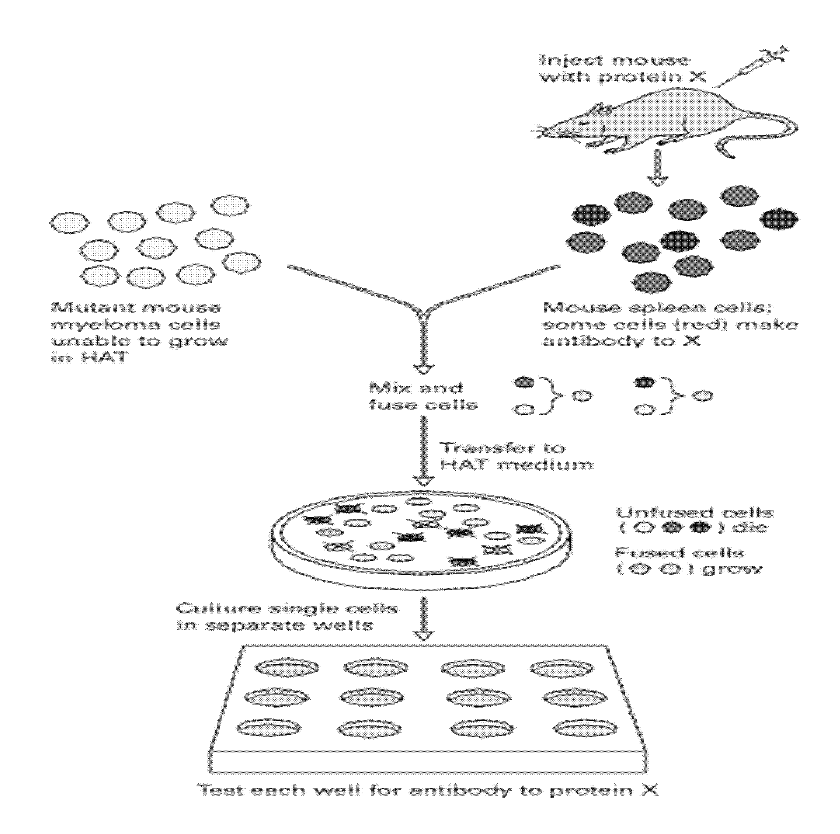
Mitotic apparatus : A specialized temporary structure, present in eukaryotic cells only during mitosis, that captures the chromosomes and then pushes and pulls them to opposite sides of the dividing cell. Consists of a central bilaterally symmetric bundle of microtubules with the overall shape of a football (the mitotic spindle) and two star-shaped tufts of microtubules (the asters), one at each pole of the spindle.

M (mitotic) phase : See cell cycle.

Mitotic spindle See mitotic apparatus.

Mobile DNA element : Any DNA sequence that is not present in the same chromosomal location in all individuals of a species.

Monoclonal antibody: Antibody produced by the progeny of a single B cell and thus a homogeneous protein exhibiting a single antigen specificity. Experimentally, it is produced by use of a hybridoma . See this method of producing monoclonal antibodies as follows:



Monomer : Any small molecule that can be linked with others of the same type to form a polymer. Examples include amino acids, nucleotides, and monosaccharides.

Monomeric : For proteins, consisting of a single polypeptide chain.

Monosaccharide: Any simple sugar with the formula (CH2O)n where n = 3 - 7.

Morbidity Rate: An incidence rate that includes all persons in a particular population who become ill during a specific period of time.

Morphogen: A molecule that specifies cell identity during development as a function of its concentration.

Morphology: The science of forms and structure of organized beings.

Mortality Rate: The number of deaths, reported in a particular population, over a specific period of time, divided by the total population, reported as deaths per 1,000 population. If the deaths are from one cause, then it is known as a disease-specific mortality rate.

Motif: In proteins, a structural unit exhibiting a particular three-dimensional architecture that is found in a variety of proteins and usually is associated with a particular function.

Motor protein: Any member of a special class of enzymes that use energy from ATP hydrolysis to walk or slide along a microfilament (myosin)

or a microtubule (dynein and kinesin).

Mottled: arked with blotches or spots of different colors or shades.

Mouse Specific Locus Test: The major test for gene mutation in whole animals. Exposed mice are bred and observed for induced hereditary changes.

MPF (mitosis-promoting factor): A heterodimeric protein, composed of a cyclin and cyclin-dependent kinase (Cdk), that triggers entrance of a cell into mitosis by inducing chromatin condensation and nuclear-envelope breakdown; originally called maturation-promoting factor.

MRNA (messenger RNA): Any RNA that specifies the order of amino acids in a protein. It is produced by transcription of DNA by RNA polymerase and, in RNA viruses, by transcription of viral RNA. In eukaryotes, the initial RNA product (primary transcript) undergoes processing to yield functional mRNA, which is transported to the cytoplasm. See also translation.

MTD: Maximum Tolerated Dose. The highest dose used in an animal cancer test which can be tolerated without serious weight loss or other toxic effects.

MTOC (microtubule-organizing center): General term for any structure (e.g., the centrosome) that organizes microtubules in nonmitotic (interphase) cells.

Mucus: A sticky substance secreted by mucous membranes.

Multiadhesive matrix proteins: Group of long flexible proteins that bind to other components of the extracellular matrix (collagen, polysaccharides) and to cell-surface receptors, thereby cross-linking the matrix to the cell membrane.

Multi Hit Model: The least conservative quantitative risk assessment model. It assumes that several interactions are needed before a cell can be killed, damaged, or transformed into a cancerous cell.

Multimeric: for proteins, containing several polypeptide chains (or subunits).

Mutagen: A chemical or physical agent that induces mutations (genetic damage).

Mutagenesis: The process whereby a substance damages DNA and produces alterations in or loss of genes or chromosomes.

Mutation: DNA damage resulting in genetic alterations ranging from changes in one or a few DNA base pairs (gene mutations) to gross changes in chromosomal structures (chromosome aberrations) or in chromosome number. It is a permanent, heritable change in the nucleotide sequence of a chromosome, usually in a single gene; commonly leads to a change in or loss of the normal function of the gene product.

Mydriatic: Any drug that dilates the pupil.

Myelin: A lipid substance that forms a sheath around certain nerve fibers.

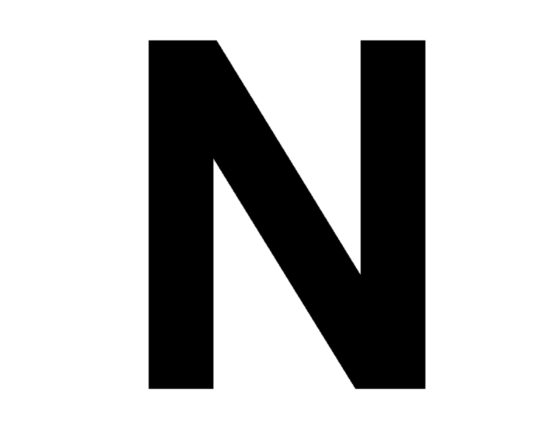
Myelinated: Covered with a myelin sheath.

Myelin sheath: Stacked specialized cell membrane that forms an insulating layer around vertebrate axons and increases the speed of impulse conduction.

Myofibril: Long, highly organized bundle of actin and myosin filaments and other proteins that constitute the basic structural unit of muscle cells (myofibers).

Myosin: One of a family of motor proteins with a globular head region and coiled-coil tail region that has actin-stimulated ATPase activity; drives movement along actin filaments during muscle contraction and cytokinesis (myosin II) and mediates vesicle translocation

(myosins I and V).



NAD+ (nicotinic adenine dinucleotide): A widely used coenzyme that participates in oxidation reactions by accepting two electrons from a donor molecule and one H+ from the solution. The reduced form, NADH, transfers electrons to carriers that function in oxidative phosphorylation.

NADP+ (nicotinic adenine dinucleotide phosphate): Phosphorylated form of NAD+, which is used extensively as an electron carrier in biosynthetic pathways and during photosynthesis.

Nanogram (ng): A unit of weight consisting of one billionth of a gram (1 x 10-9 g).

Necrosis: The death of tissue, usually in small, localized areas. It is usually referring to cell death.

NEL: No Effect Level. A quantity of a substance that is below the threshold on the dose-response curve.

Neonates: Newborn animals.

Neoplasm: An uncontrolled and progressive growth of cells. It may be benign or malignant. Same as Tumor.

Neoplastic: Pertaining to or like a neoplasm or neoplasia (tumor).

Nephrotoxin: A systemic poison whose target is the kidney.

Nernst equation: Mathematical expression that defines the electric potential E across a membrane as directly proportional to the logarithm of the ratio of the ion concentrations on either side of the membrane and inversely proportional to the valency of the ions.

Neuron (nerve cell): Any of the impulse-conducting cells of the nervous system. A typical neuron contains a cell body; several short, branched processes (dendrites); and one long process (axon).

Neuropeptide: A peptide secreted by neurons that functions as a signaling molecule either at a synapse or elsewhere. These molecules have

diverse, often long-lived effects in contrast to neurotransmitters.

Neurotoxicity: Toxicity to cells of the central nervous system (brain and spinal cord) and the peripheral nervous system (nerves outside the CNS).

Neurotoxin: A systemic poison whose target organ is the nervous system.

Neurotransmitter: Extracellular signaling molecule that is released by the presynaptic neuron at a chemical synapse and relays the signal to the postsynaptic cell. The response elicited by a neurotransmitter, either excitatory or inhibitory, is determined by its receptor on the postsynaptic cell. Examples include acetylcholine, dopamine, GABA (γ -

aminobutyric acid), and serotonin.

New Drug Application (NDA): The process by which a manufacturer of a new drug applies to the Food and Drug Administration for formal approval to market the drug.

Noncovalent bond: Any relatively weak chemical bond that does not involve an intimate sharing of electrons. Multiple noncovalent bonds often stabilize the conformation of macromolecules and mediate highly specific interactions between molecules.

Nonpolar: Referring to a molecule or structure that lacks any net electric charge or asymmetric distribution of positive and negative charges. Nonpolar molecules generally are insoluble in water.

Northern blotting: Technique for detecting specific RNAs separated by electrophoresis by hybridization to a labeled DNA probe. See also Southern blotting.

Nosocomial: Originating in a hospital.

Notice: A directive of a one-time or limited nature that has a self-canceling provision and the same force or effect as an instruction.

Nuclear envelope: Double-membrane structure surrounding the nucleus; the outer membrane is continuous with the endoplasmic reticulum and the two membranes are perforated by nuclear pores.

Nuclear lamina: Fibrous network on the inner surface of the inner nuclear membrane composed of lamin filaments.

Nuclear pore complex (NPC): Large, multiprotein structure in the nuclear envelope through which ions and small molecules can diffuse and which mediates the active transport of ribonucleoproteins and large proteins between the nucleus and cytoplasm.

Nuclear receptor: General term for intracellular receptors that bind lipid-soluble hormones (e.g., steroid hormones); also called steroid receptor superfamily. Following ligand binding, the hormonereceptor complex translocates to the nucleus and functions as a transcription factor.

Nucleic acid: A polymer of nucleotides linked by phosphodiester bonds. DNA and RNA are the primary nucleic acids in cells.

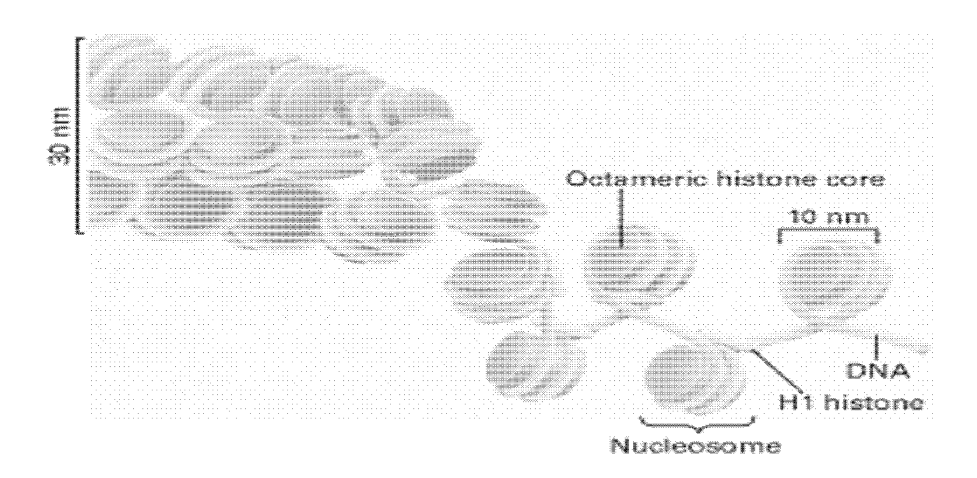
Nucleocapsid: A viral capsid plus the enclosed nucleic acid.

Nucleolus: Large structure in the nucleus of eukaryotic cells where rRNA synthesis and processing occurs and ribosome subunits are assembled.

Nucleoside: A small molecule composed of a purine or pyrimidine base linked to a pentose (either ribose or deoxyribose).

Nucleosome: Small structural unit of chromatin consisting of a disk-shaped core of histone proteins around which a 46-bp segment of DNA

is wrapped. (See next Figure)



Nucleotide: A nucleoside with one or more phosphate groups linked via an ester bond to the sugar moiety. DNA and RNA are polymers of nucleotides.

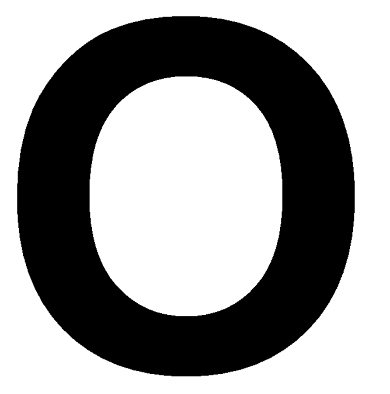
Nucleus: Large membrane-bounded organelle in eukaryotic cells that contains DNA organized into chromosomes; synthesis and processing of RNA and ribosome assembly occur in the nucleus.

Nutrition: The total process of providing the body with nutriments, and assimilating and using them. AV-8.

NIOSH: National Institute of Occupational Safety and Health. It is an institute in the Public Health Service that conducts research on health hazards in the workplace.

NOAEL: No Observed Adverse Effect Level. The highest dose in a toxicity study at which there were no toxic or adverse effects observed.

Non-Clinical Laboratory Study: A study of a pharmaceutical performed with laboratory animals which provides the basis for human clinical investigations.



Octanol / Water Partition Coefficient: The ratio of the amount of a substance that will dissolve in octanol versus the amount that will dissolve in water. The higher the octanol/water partition coefficient the greater the tendency of substance to be stored in fatty tissues.

Odds Ratio (O/R): A statistical calculation in a case-control study involving the ratio of risk of an exposed group to that of an unexposed group. An O/R=2 means that the exposed group has twice the risk of the non-exposed group.

Ointment: A semisolid, fatty, or oily preparation of medicinal substances for external application.

Okazaki fragments: Short (<1000 bases), single-stranded DNA fragments that are formed during synthesis of the lagging strand in DNA replication and are rapidly joined by DNA ligase to form a continuous DNA strand.

Olfactory: Pertaining to the sense of smell.

Oligemia: Deficiency in the volume of blood.

Oncogene: A gene whose product is involved either in transforming cell in culture or in inducing cancer in animals. Most oncogenes are mutant forms of normal genes (proto-oncogenes) involved in the control of cell growth or division.

One Hit Mode: This is the most conservative quantitative cancer assessment model. It assumes that a single molecular event can induce a cell transformation which leads to cancer.

Oocyte: Developing egg cell.

Operator: Short DNA sequence in a bacterial or viral genome that binds a repressor protein and controls transcription of an adjacent gene.

Operon: In bacterial DNA, a cluster of contiguous genes transcribed from one promoter that gives rise to a polycistronic mRNA.

Ophthalmic: Pertaining to the eye.

Organelle: Any membrane-limited structure found in the cytoplasm of eukaryotic cells.

Organism: Any living thing.

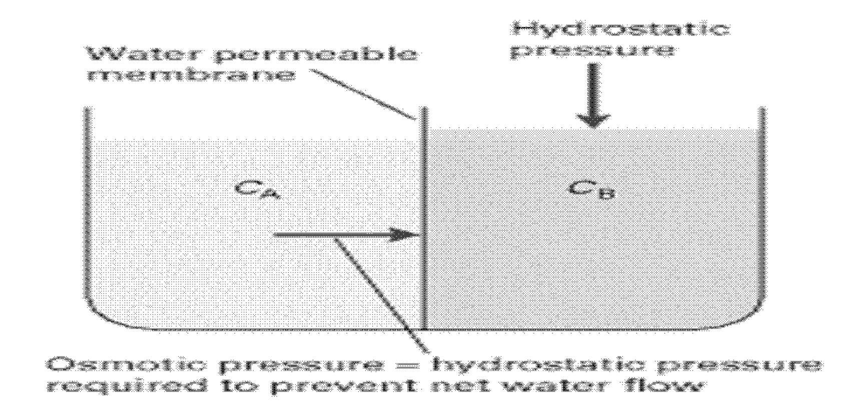
Organogenesis: The period of fetal development when the embryo differentiates and specific organs develop.

OSHA: Occupational Safety and Health Administration. The component of the Department of Labor responsible for assuring safe working conditions.

Osmosis: Net movement of water across a semipermeable membrane from a solution of lesser to one of greater solute concentration. The membrane must be permeable to water but not to solute molecules.

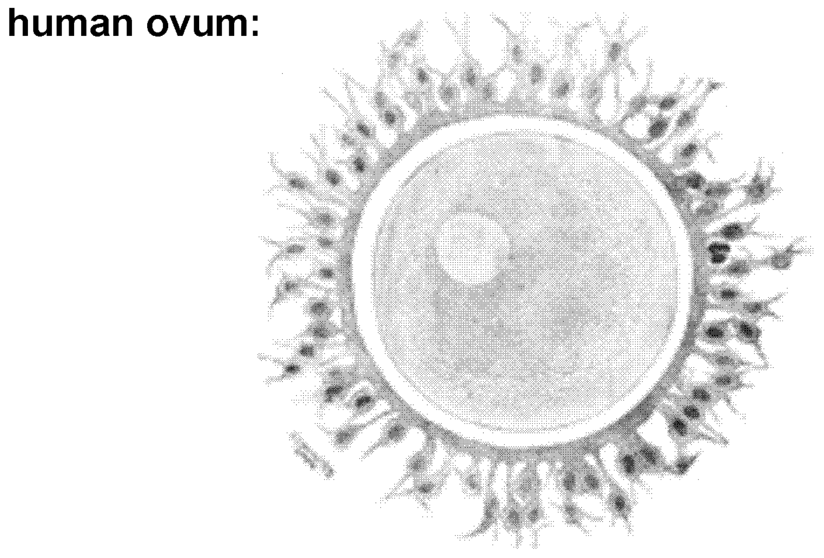
Alternatively: It is the diffusion of fluids through a membrane or porous partition.

Osmotic pressure: Hydrostatic pressure that must be applied to the more concentrated solution to stop the net flow of water across a semipermeable membrane separating solutions of different concentrations. (See next Figure):



Ossification: Changing or developing into bone.

Ovum: female reproductive cells that contribute X chromosomes. See Figure of human ovum:



Oxidation: Loss of electrons from an atom or molecule as occurs when hydrogen is removed from a molecule or oxygen is added. It means finally an union of a substance with oxygen. The opposite of reduction.

Oxidation potential: The voltage change when an atom or molecule loses an electron.

Oxidative phosphorylation: The phosphorylation of ADP to form ATP driven by the transfer of electrons to oxygen ($O2$) in bacteria and mitochondria. This process involves generation of a proton-motive force during electron transport, and its subsequent use to power ATP synthesis.

P

Palpable: Capable of being touched or felt.

Palpitation: An abnormal, rapid, regular or irregular beating of the heart, felt by the patient.

Paraplegia: Loss of motion and sensation of the lower half of the body.

Parasiticides: Drugs that kill parasites.

Parenteral: Administration of drugs by injection.

Paresis: Slight or partial paralysis.

Paroxysm: A sudden attack, or intensification of the symptoms of a disease, usually recurring periodically.

Partition Coefficient: See Octanol / water partition coefficient.

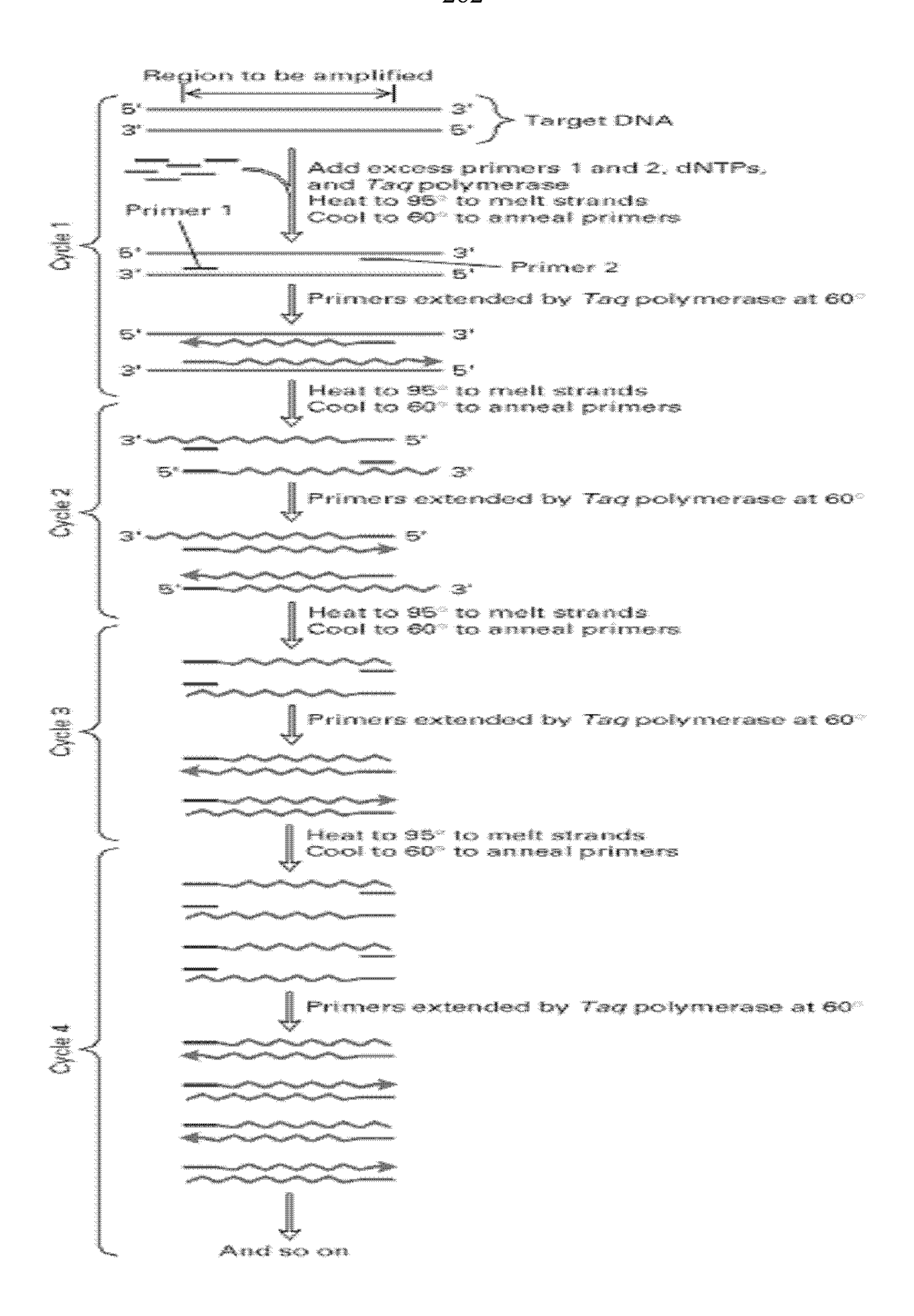
Passive (simple) diffusion: Net movement of a molecule across a membrane down its concentration gradient at a rate proportional to the gradient and the permeability of the membrane.

Passive Transfer: The movement across a membrane by simple diffusion.

Patch clamping: Technique for determining ion flow through a single ion channel or across the membrane of an entire cell by use of a micropipette whose tip is applied to a small patch of the cell membrane.

Pathology: The branch of medicine that involves the functional and structural changes in tissues and organs which are caused by disease.

PCR (polymerase chain reaction): Technique for amplifying a specific DNA segment in a complex mixture by multiple cycles of DNA synthesis from short oligonucleotide primers followed by brief heat treatment to separate the complementary strands. See next Figure:



Region to be amplified
Target DNA
Add excess primers 1 and 2, dNTPs, and Taq polymerase
Heat to 95° to melt strands
Cool to 60° to anneal primers
Primer 1
Primer 2
Primers extended by Taq polymerase at 60°
Heat to 95° to melt strands
Cool to 60° to anneal primers
Primers extended by Taq polymerase at 60°
Heat to 95° to melt strands
Cool to 60° to anneal primers
Primers extended by Taq polymerase at 60°
Heat to 95° to melt strands
Cool to 60° to anneal primers
Primers extended by Taq polymerase at 60°
And so on
Cycle 1
Cycle 2
Cycle 3
Cycle 4

Pathogen: An organism capable of producing disease or causing infections.

Pathogenicity: The capability of an infectious agent to cause disease in a susceptible host.

PEL: Permissible Exposure Level. The standard stipulated by OSHA for the highest safe level of exposure to a chemical in the workplace.

Pentose: A five-carbon monosaccharide. The pentoses ribose and deoxyribose are present in RNA and DNA, respectively.

Peptide: A small polymer usually containing fewer than 30 amino acids connected by peptide bonds.

Peptide bond: Covalent bond that links adjacent amino acid residues in proteins; formed by a condensation reaction between the amino group of one amino acid and the carboxyl group of another with release of a water molecule.

Percussion: The act of striking a body part with short, sharp blows as an aid in diagnosing the condition by evaluating the sound obtained.

Percutaneous: Movement through the skin.

Peripheral: Outward part or surface.

Peripheral membrane protein: Any protein that associates with the cytosolic or exoplasmic face of a membrane but does not enter the hydrophobic core of the phospholipid bilayer;

also called extrinsic protein. See also integral membrane protein.

Peroxisome: Small organelle in eukaryotic cells whose functions include degradation of fatty acids and amino acids by means of reactions that generate hydrogen peroxide, which is converted to water and oxygen by catalase.

Persistent: Stubborn; persevering.

Petechia: (pl. petechiae) a round pinpoint, nonraised, purplish red spot caused by hemorrhage in the skin.

PH: A measure of the acidity or alkalinity of a solution defined as the negative logarithm of the hydrogen ion concentration in moles per

liter: pH=−log [H+]. Neutrality is equivalent to a pH of 7; values below this are acidic and those above are alkaline. See next Table:

The pH Scale:

	Concentration of H+ Ions (mol/L)	pH	Example
⇈ Increasing acidity	10^{-0}	0	
	10^{-1}	1	Gastric fluids
	10^{-2}	2	Lemon juice
	10^{-3}	3	Vinegar
	10^{-4}	4	Acid soil
	10^{-5}	5	Lysosomes

	10^{-6}	6	Cytoplasm of contracting muscle
Neutral	10^{-7}	7	Pure water and cytoplasm
	10^{-8}	8	Sea water
	10^{-9}	9	Very alkaline natural soil
	10^{-10}	10	Alkaline lakes
	10^{-11}	11	Household ammonia
⇓ Increasing alkalinity	10^{-12}	12	Lime (saturated solution)
	10^{-13}	1	

3

10–14 1

4

Phage: See bacteriophage.

Phagocytosis: Process by which relatively large particles (e.g., bacterial cells) are internalized by certain eukaryotic cells. It also means t: he ingestion and destruction by phagocytes of cells, microorganisms, and other foreign matter in the blood or tissue.

Pharmacognosy: The study of the action of drugs and their uses.

Pharmacokinetics: Quantitation of the time course of chemical absorption, distribution, metabolism, and elimination.

Pharmacology: The science that deals with the origin, nature, chemistry, effects and uses of drugs.

Phenotype: The observable characteristics of a cell or organism as distinct from its genotype.

Pheromone: A signaling molecule released by an individual that can alter the behavior or gene expression of other individuals of the same species. The yeast α and a mating-type factors are well-studied examples.

Phosphatase: An enzyme that removes a phosphate group from a substrate by hydrolysis. Phosphoprotein phosphatases act with protein kinases to control the activity of many cellular proteins.

Phosphoanhydride bond: A type of high-energy bond formed between two phosphate groups, such as the γ and β phosphates and the β and α phosphates in ATP.

Phosphodiester bond: A covalent bond in which two hydroxyl groups form ester linkages to the same phosphate group; joins adjacent nucleotides in DNA and RNA.

Phosphoinositides: A family of membrane-bound lipids containing phosphorylated inositol derivatives that are important in signal-transduction pathways in eukaryotic cells.

Phospholipid bilayer: A symmetrical two-layer structure, found in all biomembranes, in which the polar head groups of phospholipids are exposed to the aqueous medium, while the

nonpolar hydrocarbon chains of the fatty acids are in the center.

Phospholipids: The major class of lipids present in biomembranes, usually composed of two fatty acid chains esterified to two of the carbons of glycerol phosphate, with the phosphate esterified to one of various polar groups.

Photosynthesis: Complex series of reactions occurring in some bacteria and plant chloroplasts whereby light energy is used to generate carbohydrates from CO_2, usually with the consumption of H_2O and evolution of O_2.

Phototoxic: The enhanced toxicity of a substance in or on the skin due to exposure to light (usually ultraviolet light).

Physiological: Characteristic of or appropriate to an organism's functioning.

Physiologically-Based Pharmacokinetic

Model (PB-PK): A risk assessment model that quantitates risk using biological data on the absorption of a foreign substance, its distribution, metabolism, storage is tissues, and elimination.

Picogram (pg): A unit of weight consisting of one quadrillionth of a gram (1 x 10-12 g).

Plexus: Network.

pl: See isoelectric point.

Pinocytosis: The nonspecific uptake of small droplets of extracellular fluid into endocytic vesicles.

Plaque assay: Technique for determining the number of infectious viral particles in a sample by culturing a diluted sample on a layer of susceptible host cells and then counting the clear areas of lysed cells (plaques) that develop.

Plasma membrane: The membrane surrounding a cell that separates the cell from its external environment, consisting of a phospholipid bilayer and associated proteins.

Plasmid: Small, circular extrachromosomal DNA molecule capable of autonomous replication in a cell. Commonly used as a cloning vector.

Plasmodesmata (sing. plasmodesma): Tubelike cell junctions that interconnect the cytoplasm of adjacent plant cells and are functionally analogous to gap junctions in animal cells.

Point mutation: Change of a single nucleotide in DNA, especially in a region coding for protein; can result in formation of a codon specifying a different amino acid or a stop codon , or a shift in the reading frame .

Poison: A substance capable of causing toxicity when absorbed into the body in a relatively small quantity.

Polar: Referring to a molecule or structure with a net electric charge or asymmetric distribution of positive and negative charges. Polar molecules are usually soluble in water.

Polarity: Presence of functional and/or structural differences in distinct regions of a cell or cellular component.

Polymer: Any large molecule composed of multiple identical or similar units (monomers) linked by covalent bonds.

Polymerase chain reaction: See PCR.

Polypeptide: Linear polymer of amino acids connected by peptide bonds. Proteins are large polypeptides, and the two terms commonly are used interchangeably.

Polyploidy: An increase in the normal number of chromosomes.

Polyribosome: A complex containing several ribosomes all translating a single messenger RNA; also called polysome.

Polysaccharide: Linear or branched polymer of monosaccharides, linked by glycosidic bonds, usually containing more than 15 residues. Examples include glycogen, cellulose, and glycosaminoglycans.

Positional cloning: Isolation and cloning of the normal form of a mutation-defined gene (i.e., a gene identified by genetic analysis of mutants).

Power of the Study: The statistical ability of a study to detect an effect.

PPB: Parts per billion. The number of units of a substance in a billion units. PPB is a common concentration unit for dilute samples of dissolved substances or airborne substances.

PPM: Parts per million - the number of units of a substance in a million units. PPM is a common concentration unit for dilute samples of dissolved substances or airborne substances.

Precipitation: The quality or state of being separated from solution or suspension by chemical or physical change, usually as an insoluble amorphous or crystalline solid.

Pre-mRNA: Precursor messenger RNA ; the primary transcript and intermediates in RNA

processing.

Pre-rRNA: Large precursor ribosomal RNA that is synthesized in the nucleolus of eukaryotic cells and processed to yield three of the four RNAs present in ribosomes.

Primary Dermal Irritation Test: A test with laboratory animals (usually rabbits) that determines dermal toxicity of a substance when applied to the skin. It is manifest mainly by erythema, edema, and eschars.

Primary structure: In proteins, the linear arrangement (sequence) of amino acids and the location of covalent (mostly disulfide) bonds within a polypeptide chain.

Primary transcript: Initial RNA product, containing introns and exons, produced by transcription of DNA. Many primary transcripts must undergo RNA processing to form the physiologically active RNA species.

Primase: A specialized RNA polymerase that synthesizes short stretches of RNA used as primers for DNA synthesis.

Primer: A short nucleic acid sequence containing a free 3′ hydroxyl group that forms base pairs with a complementary template strand and functions as the starting point for addition of nucleotides to copy the template strand.

Probe: Defined RNA or DNA fragment, radioactively or chemically labeled, that is used to detect specific nucleic acid sequences by hybridization.

Probit Model: A risk assessment model that assumes log normal distribution for tolerances of an exposed population. It is generally considered inappropriate for the assessment of cancer risk.

Prokaryotes: Class of organisms, including the eubacteria and archaea, that lack a true membrane-limited nucleus and other organelles. See also eukaryotes.

Promoter: DNA sequence that determines the site of transcription initiation for an RNA polymerase.

Promoter-proximal element: Any regulatory sequence in eukaryotic DNA that is located within ≈200 base pairs of the transcription start site. Transcription of many genes is controlled by multiple promoter-proximal elements.

Proofreading: It is a process of discovering mistakes in DNA sequence during replication and its correction by DNA polymerase enzyme.

Prone: lying face down.

Prophase: Earliest stage in mitosis during which the chromosomes condense and the centrioles begin moving toward the spindle poles.

Prophylactic: The prevention of disease; preventive treatment. AV-9.

Proportion: Two equal ratios considered simultaneously.

Prospective Cohort Study: An epidemiology study in which cohorts are identified according to current exposures. The cohort is followed over time for the development of specific effects, such as cancer.

Prosthetic group: A nonpeptide organic molecule or metal ion that binds tightly and specifically with a protein and is required for its activity, such as heme in hemoglobin. See also coenzyme.

Prostration: Utter exhaustion.

Proteasome : Large multifunctional protease complex in the cytosol that degrades intracellular proteins marked for destruction by attachment of multiple ubiquitin molecules.

Protein: A linear polymer of amino acids linked together in a specific sequence and usually containing more than 50 residues. Proteins form the key structural elements in cells and participate in nearly all cellular activities.

Proteoglycans: A group of glycoproteins that contain a core protein to which is attached one or more glycosaminoglycans. They are found in nearly all extracellular matrices, and some are attached to the plasma membrane.

Proton-motive force: The energy equivalent of the proton (H+) concentration gradient and electric potential gradient across a membrane; used to drive ATP synthesis by ATP synthase, transport of molecules against their concentration gradient, and movement of bacterial flagella.

Proto-oncogene: A normal cellular gene that encodes a protein usually involved in regulation of cell growth or proliferation and that can be mutated into a cancer-promoting oncogene, either by changing the protein-coding segment or by altering its expression.

Pruritis: Intense itching.

Psychological: Belonging to or of the nature of psychology; the mental process.

Pulse-chase: A type of experiment in which a radioactive small molecule is added to a cell for a brief period (the pulse) and then is replaced with an excess of the unlabeled form of same small molecule (the chase). Used to detect changes in the cellular location of a molecule or its metabolic fate over time.

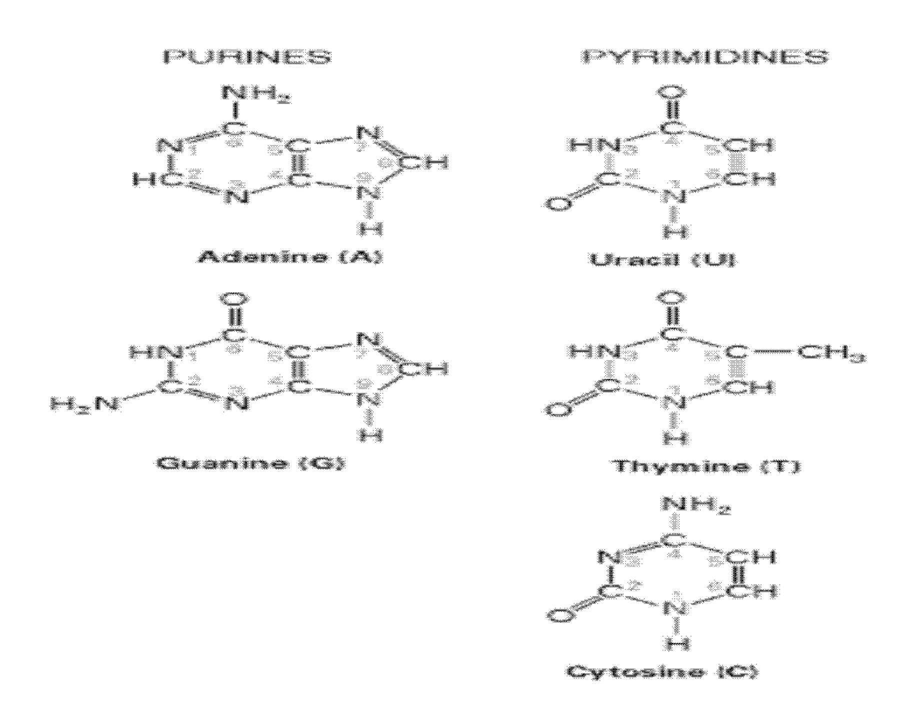
Pump: Any transmembrane protein that mediates the active transport of an ion or small molecule across a biomembrane.

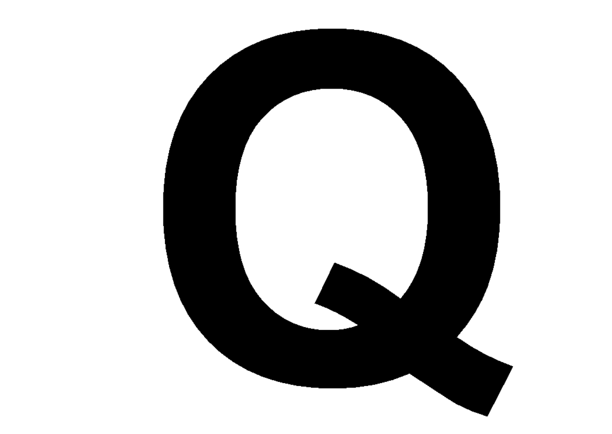
Purines: A class of nitrogenous compounds containing two fused heterocyclic rings. Two purines, adenine and guanine, commonly are found in DNA and RNA.

Purulent: Pus filled or containing pus.

Pustule: A small, inflamed elevation of the skin containing pus.

Pyrimidines: A class of nitrogenous compounds containing one heterocyclic ring. Two pyrimidines, cytosine and thymine, commonly are found in DNA; in RNA, uracil replaces thymine. (See next Figure for both purines and pyrimidines):





Quadraplegia: Loss of motion and sensation below the neck.

Quaternary structure: The number and relative positions of the polypeptide chains in multisubunit proteins.

Quiescent: Referring to a cell that has exited the cell cycle and is in the G0 state.

R

Radioisotope: Unstable form of an atom that emits radiation as it decays. Several radioisotopes are commonly used experimentally as labels in biological molecules.

Rales: An abnormal sound, either moist or dry, classified by location (e.g., bronchial rales, laryngeal rales).

Ras protein: A monomeric GTP-binding protein that functions in intracellular signaling pathways and is activated by ligand binding to receptor tyrosine kinases and other cell-surface receptors. See also GTPase superfamily.

Ratio: The relationship of one quantity to another of like units.

Reading frame: The sequence of nucleotide triplets (codons) that runs from a specific translation start codon in a mRNA to a stop codon. Some mRNAs can be translated into different polypeptides by reading in two different reading frames.

Receptor: Any protein that binds a specific extracellular signaling molecule (ligand) and then initiates a cellular response. Receptors for steroid hormones, which diffuse across the plasma membrane, are located within the cell; receptors for water-soluble hormones, peptide growth factors, and neurotransmitters are located in the plasma membrane with their ligand-binding domain exposed to the external medium.

Receptor tyrosine kinase (RTK): Member of an important class of cell-surface receptors whose cytosolic domain has tyrosine-specific protein kinase activity. Ligand binding activates this kinase activity and initiates intracellular signaling pathways.

Recessive: In genetics, referring to that allele of a gene that is not expressed in the phenotype when the dominant allele is present. Also refers to the phenotype of an individual (homozygote) carrying two recessive alleles. See next Figure:

Recombinant DNA: Any DNA molecule formed by joining DNA fragments from different sources. Commonly produced by cutting DNA molecules with restriction enzymes and then joining the resulting fragments from different sources with DNA ligase. See next Table:

Selected Restriction Endonucleases and their Restriction-Site Sequences

Source Microorganism	Enzyme*	Recognition Site (↓)†	Ends Produced
Arthrobacter luteus	AluI	AG↓CT	Blunt
Bacillus amyloliquefaciens H	Bam HI	G↓GATCC	Sticky

Escherichia coli	**EcoRI**	**G↓AATTC**	**Sticky**
Haemophilus gallinarum	**HgaI**	**GACGC+5↓**	‡
Haemophilus influenzae	**HindIII**	**A↓AGCTT**	**Sticky**
Haemophilus parahaemolyticus	**HphI**	**GGTGA+8↓**	‡
Nocardia otitiscaviaruns	**NotI**	**GC↓GGCCGC**	**Sticky**
Staphylococcus aureus 3A	**Sau3AI**	**↓GATC**	**Sticky**
Serratia marcesens	**SmaI**	**CCC↓GGG**	**Blunt**
Thermus aquaticus	**TaqI**	**T↓CGA**	**Sticky**

*** Enzymes are named with abbreviations of the bacterial strains from which they are isolated; the roman numeral indicates the enzyme's priority of discovery in that strain (for example, AluI was the first restriction enzyme to be isolated from Arthrobacter luteus). Recognition sequences are written 5′→3′ (only one strand is given), with the cleavage site indicated by an arrow. Enzymes producing blunt ends cut both strands at the indicated site; those producing stick ends make staggered cuts, with cleavage occurring between the same nucleotides in each strand**

Recombination: Any process in which chromosomes or DNA molecules are cleaved and the fragments are rejoined to give new combinations. Occurs naturally in cells as the result of the exchange (crossing over) of DNA

sequences on maternal and paternal chromatids during meiosis; also is carried out in vitro with purified DNA and enzymes.

Reduction: Gain of electrons by an atom or molecule as occurs when hydrogen is added to a molecule or oxygen is removed. So, it is a change in a chemical characterized by the gain of electrons. The opposite of oxidation.

Reduction potential: The voltage change when an atom or molecule gains an electron.

Reference Dose (RfD): The EPA estimate of a lifetime daily exposure level for humans that is likely to be without risk of harmful effects. RfD's are acceptable safety levels for chronic non-carcinogenic and developmental effects. The process used to derive an RfD is a modification

of that used to derive an ADI.

Relative Risk (RR): A statistical calculation of the ratio of disease in an exposed population to that of an unexposed population.

Replication fork: See growing fork.

Replication origin: Unique DNA segments present in an organism's genome at which DNA replication begins. Eukaryotic chromosomes contain multiple origins, whereas bacterial chromosomes and plasmids often contain just one.

Replicon: Region of DNA served by one replication origin.

Reproductive Toxicity: Toxicity of the male or female reproductive system. Toxic effects may include damage to the reproductive organs or offspring.

Reservoir: A carrier on which an infectious agent depends primarily for survival.

Resistance: The sum total of body mechanisms that provide barriers to the invasion of infectious agents or their toxic products.

Resolution: The minimum distance that can be distinguished by an optical apparatus; also called resolving power.

Respiration: General term for any cellular process involving the uptake of O2 coupled to production of CO2.

Respiratory Toxicity: Toxicity of the upper (nose, pharynx, larynx, and trachea) or lower (bronchi, bronchioles, and lung alveoli) respiratory system.

Restriction enzyme (endonuclease) : Any enzyme that recognizes and cleaves a specific short sequence, the restriction site, in double-stranded DNA molecules. These enzymes are widespread in bacteria and are used extensively in recombinant DNA technology.

Restriction fragment: A defined DNA fragment resulting from cleavage with a particular restriction enzyme. These fragments

are used in the production of recombinant DNA molecules and DNA cloning.

Restriction point: The point in late G1 of the cell cycle at which mammalian cells become committed to entering the S phase and completing the cycle even in the absence of growth factors.

Retrospective Cohort Study: An epidemiology study in which cohorts are identified according to past exposure conditions and follow-up proceeds forward in time.

Retrotransposon: Type of eukaryotic mobile DNA element whose movement in the genome is mediated by an RNA intermediate and involves a reverse transcription step. See also

transposon.

Retrovirus: A type of eukaryotic virus containing an RNA genome that replicates in cells by first making a DNA copy of the RNA. This proviral DNA is inserted into cellular chromosomal DNA, and gives rise to further genomic RNA as well as the mRNAs for viral proteins.

Reverse transcriptase: Enzyme found in retroviruses that catalyzes synthesis of a double-stranded DNA from a single-stranded RNA template.

RfD: see Reference Dose.

Rhinorrhea: The free discharge of a thin nasal mucus.

Rhonchus: (pl. rhoncii) A rattling throat sound due to partial obstruction; a dry coarse rale in the bronchial tubes.

Ribosomal RNA: See rRNA.

Ribosome: A large complex comprising several different rRNA molecules and more than 50 proteins, organized into a large subunit and small subunit; the site of protein synthesis.

Ribozyme: An RNA molecule or segment with catalytic activity.

Risk: The probability that a hazard or effect will occur at a specific level of exposure.

Risk Assessment: The process by which the probability that an adverse effect will occur at a defined exposure level is determined.

Risk Characterization: The final stage in the risk assessment process which involves the prediction of the frequency and severity of effects in exposed populations.

Risk Management: The process of weighing policy alternatives and selecting the most appropriate regulatory action based on the results of risk assessment and social, economic, and political concerns.

RNA (ribonucleic acid): Linear, single-stranded polymer composed of ribose nucleotides, that is synthesized by transcription of DNA or by copying of RNA. The three types of cellular RNA

— mRNA, rRNA, and tRNA — play different roles in protein synthesis.

RNA editing: Unusual type of RNA processing in which the sequence of a pre-mRNA is altered.

RNA polymerase: An enzyme that copies one strand of DNA or RNA (the template strand) to make the complementary RNA strand using as substrates ribonucleoside triphosphates.

RNA processing: Various modifications that occur to many but not all primary transcripts to yield functional RNA molecules.

RNA splicing: A process that results in removal of introns and joining of exons in RNAs. See also spliceosome.

RRNA (ribosomal RNA): Any one of several large RNA molecules that are structural and functional components of ribosomes. Often designated by their sedimentation coefficient: 28S, 18S, 5.8S, and 5S rRNA in higher eukaryotes.

S

(Synthesis) phase: See cell cycle.

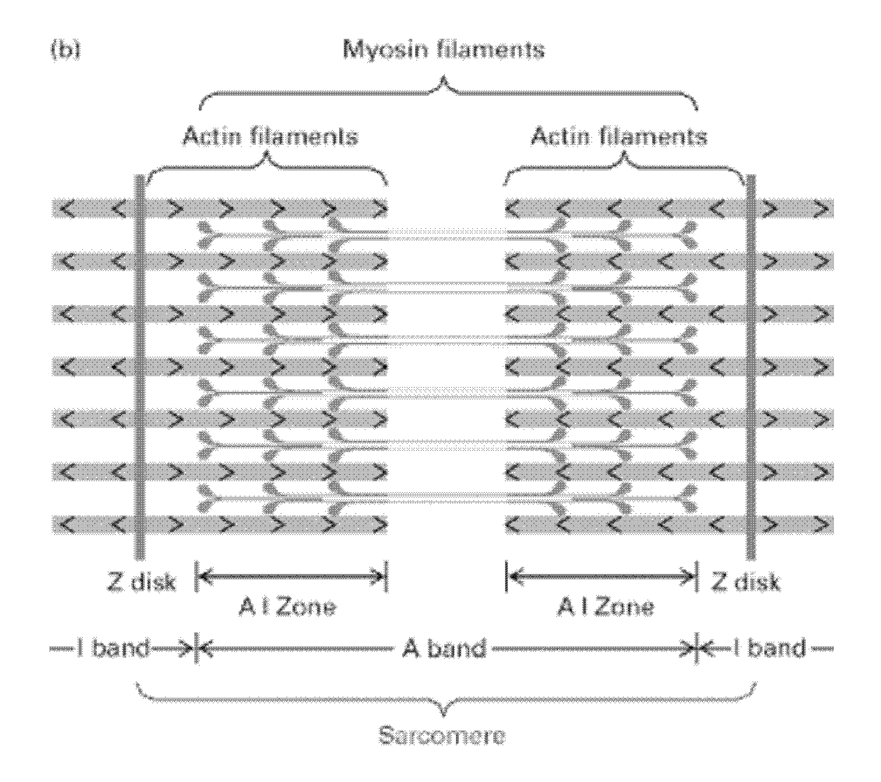
Sacrum: Triangular bone just below the lumbar vertebrae.

Safety Factor: Factors used in the calculation of acceptable humans or environmental exposures. They are applied to data from laboratory experiments or epidemiology studies. Factors of 10 are normally used to account for such uncertainties in the data on which risk assessments are made. Similar to uncertainty factors.

Sanitization: The process of cleaning with soap and water or boiling to reduce the number of organisms to a safe level.

Sarcoma: A malignant tumor derived from connective tissue.

Sarcomere: Repeating unit of a myofibril in striated muscle that extends from one Z disk to an adjacent one and shortens during contraction. (See next Figure):



Sarcoplasmic reticulum: Network of membranes that surrounds each myofibril in a muscle cell and sequesters Ca2 ions. Stimulation of a muscle cell induces release of Ca2 ions into the cytosol, triggering coordinated contraction along the length of the cell.

Schwann cell: Type of glial cell that forms the myelin sheath around axons in the peripheral nervous system.

Second messenger: An intracellular signaling molecule whose concentration increases (or decreases) in response to binding of an extracellular ligand to a cell-surface receptor. Examples include cAMP, Ca2, diacylglycerol (DAG), and inositol 1, 4, 5-trisphosphate (IP3).

Secondary structure: In proteins, local folding of a polypeptide chain into regular structures including the α helix, β sheet, and U-shaped turns and loops.

Secretory vesicle: Small membrane-bound organelle containing molecules destined to be released from the cell.

Segregation: In genetics, the process that distributes an equal complement of chromosomes to daughter cells during mitosis and meiosis.

Selection Bias: Systematic error that may be introduced in sampling by selecting one population over another.

Selective Toxicity: Selective toxicity refers to species differences in toxicity between two species simultaneously exposed.

Sensitization: An immune capability developed following an individual's exposure to a specific antigen. Subsequent exposure results in an immune reaction.

Sensitizer: A substance that causes an allergic immune response.

Sepsis: The growth of pathogens in living tissue.

Serum: (pl. serums or sera) The watery portion of an animal fluid remaining after coagulation; plasma minus the clotting proteins

and clotting cells.

Seven-spanning receptor: See G protein-coupled receptor (GPCR).

Shock: Collapse of the cardiovascular system, characterized by circulatory deficiency and depression of vital functions.

Signal sequence: A relatively short amino acid sequence that directs a protein to a specific location within the cell; also called signal peptide and targeting sequence.

Signal transduction: Conversion of a signal from one physical or chemical form into another. In cell biology commonly refers to the sequential process initiated by binding of an extracellular signal to a receptor and

culminating in one or more specific cellular responses.

Signaling molecule: General term for any extracellular or intracellular molecule involved in mediating the response of a cell to its external environment or other cells.

Silencer sequence: A sequence in eukaryotic DNA that promotes formation of condensed chromatin structures in a localized region, thereby blocking access of proteins required for transcription of genes within several hundred base pairs of the silencer sequence.

Simple-sequence DNA: Short, tandemly repeated sequences that are found in centromeres and telomeres as well as at other chromosomal locations and are not transcribed.

Sister Chromatid Exchange Assay (SCE): A mutation test in which bone marrow cells or lymphocytes of exposed individuals are microscopically examined for complete chromosome breakage and errors in rejoining of chromatid fragments. Errors are detected by demonstrating that there has been an exchange in the sister chromatids during the rejoining process.

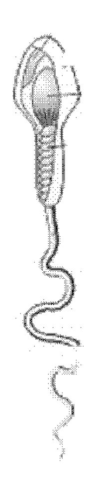
Slope of the Dose-Response Curve: Rate of buildup of toxic effects with increasing doses.

Solubility: Ability of a substance to be dissolved in a solvent. The solubility is expressed according to the solvent, e.g., water solubility, solubility in acetone, etc.

Somatic cell: Any plant or animal cell other than a germ cell or germ-cell precursor. I;e : A body cell other than germ cell.

Southern blotting: Technique for detecting specific DNA sequences separated by electrophoresis by hybridization to a labeled nucleic acid probe.

Sperm: A sperm cell, spermatozoon (pl. spermatozoa) (in Greek: sperm a = seed and zoon = alive) , it is male reproductive cell that contributes X and Y chromosomes. See next Figure for sperm structure:



SPF (S phase - promoting factor) : A heterodimeric protein, composed of a cyclin and cyclin-dependent kinase (Cdk), that triggers entrance of a cell into the S phase of the cell cycle by inducing expression of proteins required for DNA replication and passage through the S phase.

Spirits: Alcoholic or hydroalcoholic solutions of volatile substances.

Spliceosome: Large ribonucleoprotein complex that assembles on a pre-mRNA and carries out RNA splicing.

Spore: A microorganism in a resting or dormant state that renders it highly resistant to destruction.

Sprain: Injury to the ligaments and soft tissues that support a joint.

Standard Deviation: The statistical calculation denoting the variability of responses to an exposure. One standard deviation incorporates 68% of the responses while two standard deviations incorporates 95% of the responses.

Standardized Mortality Ratio (SMR): A statistical calculation in an epidemiology study which compares the relative risk of death of an exposed group to a non-exposed group. It is the most commonly used measure for reporting the results of cohort studies.

Starch: A very long, branched polysaccharide, composed exclusively of glucose units, that is the primary storage carbohydrate in plant cells.

Start : A point in the G1 stage of the yeast cell cycle that controls entry of cells into the S phase. Passage of a cell through start commits a cell to proceed through the remainder of the cell cycle.

Steatosis: Lipid accumulation in hepatocytes.

Stem cell: A self-renewing cell that divides to give rise to a cell with an identical developmental potential and/or one with a more restricted developmental potential.

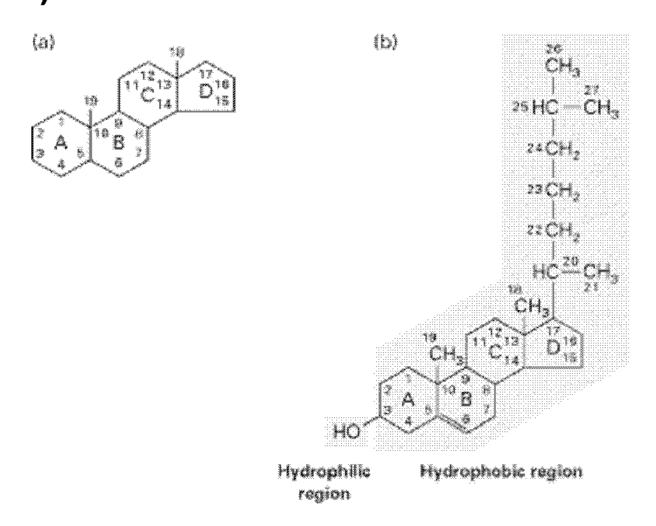
Stereoisomers: Two compounds with identical molecular formulas whose atoms are linked in the same order but in different spatial arrangements. In optical isomers, designated d and l, the atoms bonded to an asymmetric carbon atom are arranged in a mirror-image fashion. Geometric isomers include the cis and trans forms of molecules containing a double bond.

Sterile: Free of all living organisms.

Sterilization: The process of destroying all organisms on a substance or article by exposure to physical or chemical agents; the process by which all organisms, including spores, are destroyed.

Sternuntators: Vomiting agents.

Steroid: A group of four-ring hydrocarbons including cholesterol and related compounds. Many important hormones (e.g., estrogen and progesterone) are steroids. (See the next Figures for cholesterol and and steroidal nucleous):



Strain: Forcible overstretching or tearing of a muscle or tendon.

Striated: Striped or streaked. AV-10 .

Stridor: A harsh, high-pitched respiratory sound such as the inspiratory sound often heard in acute laryngeal obstruction.

Structure-Activity Relationship (SAR): The process by which the toxicity of a substance can be predicted based on its similarity in structure to that of other chemicals for which the toxicity is known.

Subchronic Toxicity: The adverse effects of a substance resulting from repeated exposure to a toxic agent over a period of several weeks or months.

Subcutaneous: Under the skin.

Sublingual: Under the tongue.

Substrate: Molecule that undergoes a change in a reaction catalyzed by an enzyme.

Substrate-level phosphorylation: Formation of ATP from ADP and Pi catalyzed by cytosolic enzymes in reactions that do not depend on a proton-motive force.

Sulfhydryl group (- SH): A hydrogen atom covalently bonded to a sulfur atom; also called a thiol group. A substituent group present in the amino acid cysteine and other molecules.

Supercoils, DNA: Regions of DNA in which the double helix is twisted on itself.

Superficial: Of or pertaining to the surface, lying on, not penetrating below.

Supine: Lying on the back.

Suppressor mutation: A mutation that reverses the phenotypic effect of a second mutation. Suppressor mutations are frequently used to identify genes encoding interacting proteins.

Surgical Aspect Technique: The practice that renders and keeps objects and areas free from all organisms.

Surgically Clean: Clean but not sterile.

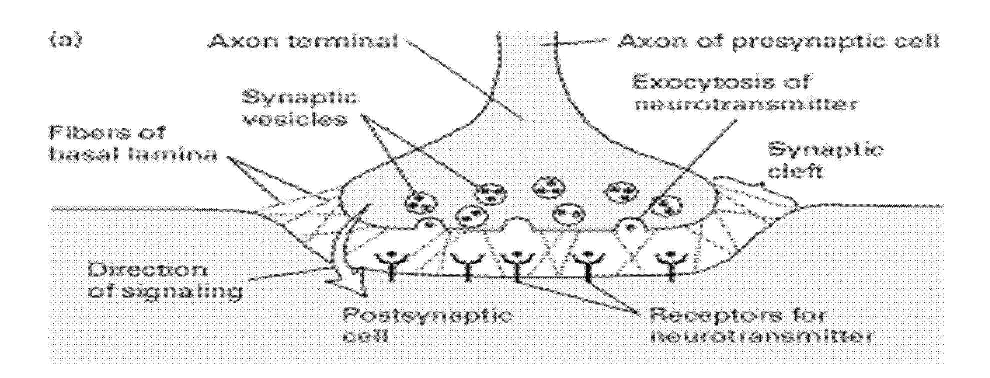
Susceptible: Not resistant. A person or animal who may acquire an infection or disease when exposed to a specific agent, because his or her resistance to the agent is lacking or reduced.

Suspect: A person who may have acquired a communicable disease; it is indicated by the medical history and clinical presentation.

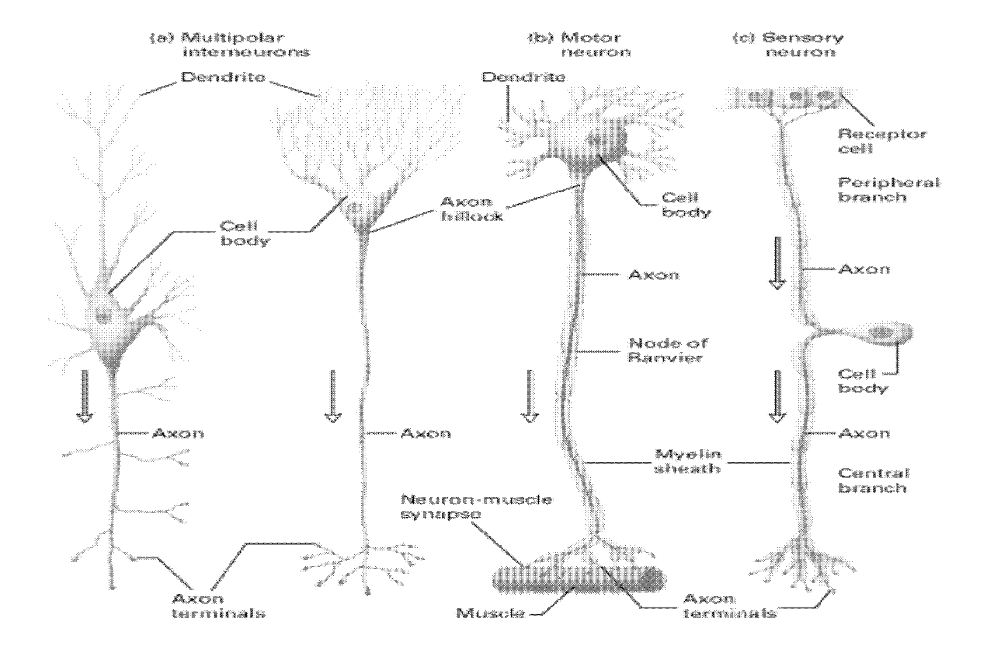
Suspension: A coarse dispersion of finely divided insoluble material suspended in a liquid medium.

Symport: A type of cotransport in which a membrane protein (symporter) transports two different molecules or ions across a cell membrane in the same direction. See also antiport.

Synapse: Specialized region between an axon terminus of a neuron and an adjacent neuron or other excitable cell (e.g., muscle cell) across which impulses are transmitted. At a chemical synapse, the impulse is conducted by a neurotransmitter; at an electric synapse, impulse transmission occurs via gap junctions connecting the cyto-plasms of the pre- and postsynaptic cells. (See next Figure for synapse) :



Also, See the Nerve cell (Neuron) in the next Figure:



Syncope: Faintness or actual fainting.

Syncytium: A multinucleated mass of cytoplasm enclosed by a single plasma membrane.

Synergist: A medicine that aids or cooperates with another.

Syrup: Concentrated aqueous solutions of sucrose, containing flavoring or medicinal substances.

Systemic toxin: A toxin that affects the entire body or many organs.

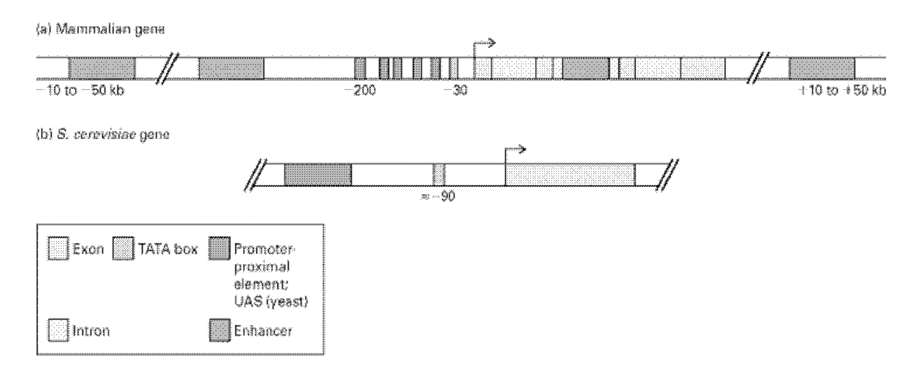
T

Tachycardia: Excessively rapid heartbeat, usually over 100.

Taeniafuge: A drug that expels tapeworms without necessarily killing them.

Target Organ: An organ in which a xenobiotic exerts a toxic effect.

TATA box: A conserved sequence in the promoter of many eukaryotic protein-coding genes where the transcription-initiation complex assembles. (See next Figure):



(This Figure shows the general pattern of cis-acting control elements that regulate gene expression in yeast and multicellular organisms (invertebrates, vertebrates, and plants):

Genes of multicellular organisms contain both promoter-proximal elements and enhancers as well as a TATA box or other promoter element. The latter positions RNA polymerase II to initiate transcription at the start site and influences the rate of transcription. Enhancers may be either upstream or downstream and as far away as 50 kb from the transcription start site. In some cases, promoter-proximal elements occur downstream from the start site as well. (b) Most yeast genes contain only one regulatory region, called an upstream activating sequence (UAS), and a TATA box, which is ≈ 90 base pairs upstream from the start site.

TD0: Toxic Dose 0%. The estimated dose none of the population is expected to exhibit toxic effects.

TD50: Toxic Dose 50%. The estimated dose at which 50% of the population exhibit toxic effects.

TD90: Toxic Dose 90%.The estimated dose at which 90% of the population exhibit toxic effects.

Telomere: End region of a eukaryotic chromosome containing characteristic telomeric (TEL) sequences that are replicated by a special process, thereby counteracting the tendency of a chromosome to be shortened during each round of replication.

Telophase: Final mitotic stage during which the nuclear-envelope re-forms around the two sets of separated chromosomes; the chromosomes decondense; and division of the cytoplasm (cytokinesis) is completed.

Temperature-sensitive (ts)

mutant: A cell or organism with a mutant gene encoding an altered protein that functions normally at one temperature (the permissive temperature) but is nonfunctional at another temperature (the nonpermissive temperature).

Template: A molecular “mold” that dictates the structure of another molecule; most commonly, one strand of DNA that directs synthesis of a complementary DNA strand during DNA replication or of an RNA during transcription.

Tendon: A fibrous cord by which a muscle is attached to the skeleton.

Teratogen: A compound that causes birth defects in a developing fetus.

Teratogenesis: The process by which a substance causes the abnormal development of tissues or organs in a developing fetus.

Teratogenicity: The development of birth defects as the result of exposure to a teratogenic toxicant.

Termination factor: One of several proteins that acts to terminate protein synthesis by recognizing a stop codon in mRNA and causing release of the ribosomal subunits.

Tertiary structure: in proteins, overall three-dimensional form of a polypeptide chain, which is stabilized by multiple noncovalent interactions between side chains.

Tertorous: Snoring-type breathing sound.

Therapeutic Index (TI): The ratio of the dose needed to produce the desired therapeutic response to the dose producing toxicity.

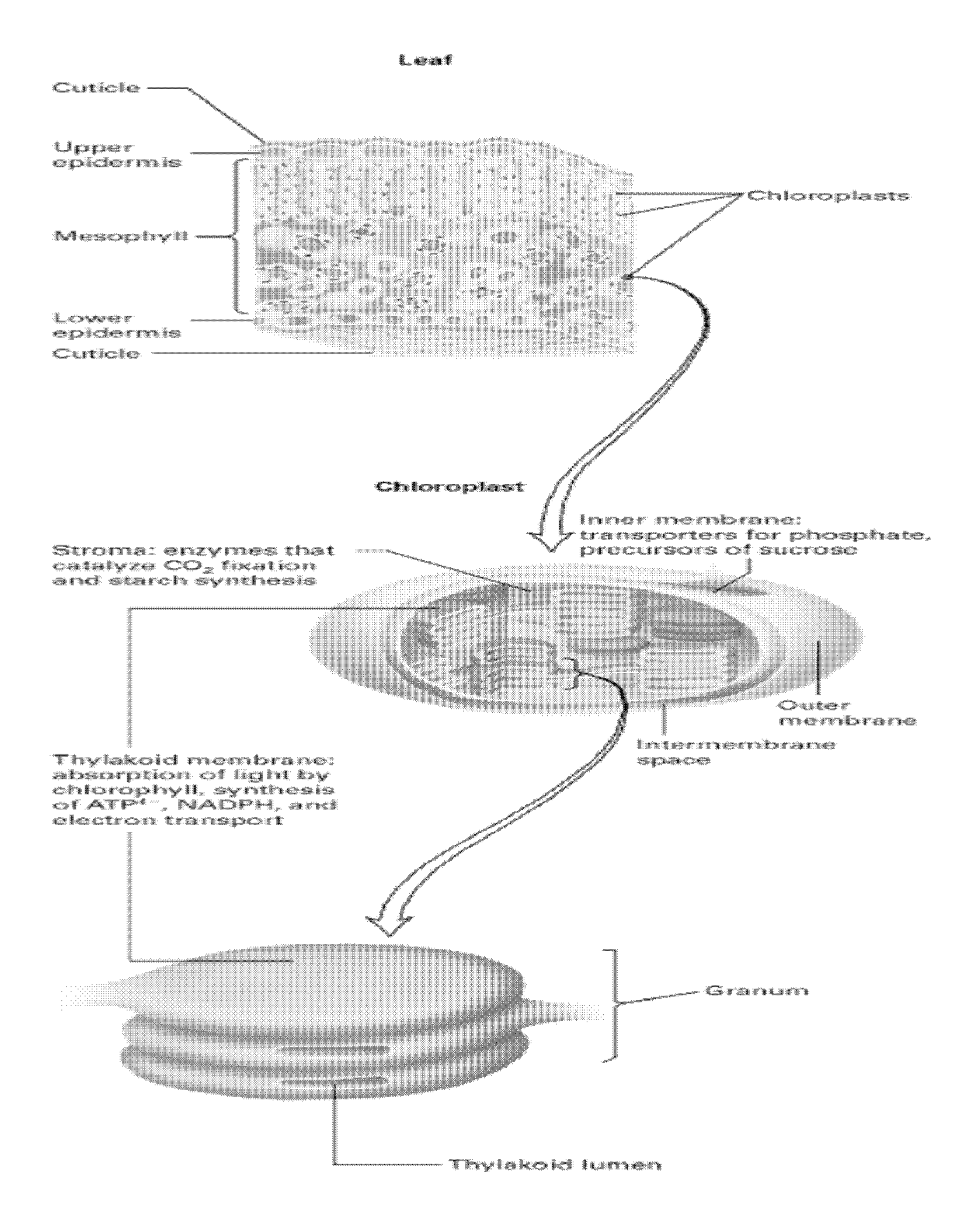
Thoracic: Pertaining to or affecting the chest.

Threshold Dose: The dose at which a toxic effect is first encountered.

Threshold Limit Value (TLV): A recommendation by the ACGIH for the highest level of exposure to a chemical that is safe.

Thrombus: A plug or clot in a blood vessel or in one of the cavities of the heart, formed by coagulation of the blood. It remains where it was formed.

Thylakoids: Flattened membranous sacs in a chloroplast that are arranged in stacks forming the grana and contain the photosynthetic pigments. (See next Figure):



Leaf
Cuticle
Upper epidermis
Mesophyll
Lower epidermis
Cuticle
Chloroplasts
Chloroplast
Inner membrane: transporters for phosphate, precursors of sucrose
Stroma: enzymes that catalyze CO_2 fixation and starch synthesis
Outer membrane
Intermembrane space
Thylakoid membrane: absorption of light by chlorophyll, synthesis of ATP^{4-}, NADPH, and electron transport
Granum
Thylakoid lumen

Tight junction: Ribbon-like bands connecting adjacent epithelial cells that prevent leakage of fluid across the cell layer.

Tincture: Usually an alcoholic solution of animal or vegetable drugs.

Tinnitus: Ringing in the ears.

TLV: see Threshold Limit Value .

Tolerance: The ability to endure unusually large doses of a substance without ill effect. Toxic effects are decreased with continued exposure to the substance.

Topoisomerase: Class of enzymes that control the number and topology of super coils in DNA. Type I enzymes cut one DNA strand, rotate it about the other, and reseal the ends. Type II enzymes cut and reseal both DNA strands.

Total Dose: The sum of all individual doses which may be received over a period of time.

Toxemia: Poisonous products in the blood.

Toxicant: An agent that produces adverse effects when absorbed into the body.

Toxicokinetics: The pharmacokinetics of a toxic chemical.

Toxicologist: A person who studies harmful effects of chemicals including the mechanisms by which the effects are produced and the probability that the effects will occur under specific exposure conditions.

Toxicology: The study of the harmful interactions of chemicals on living organisms and biological systems. It is the science of poisons.

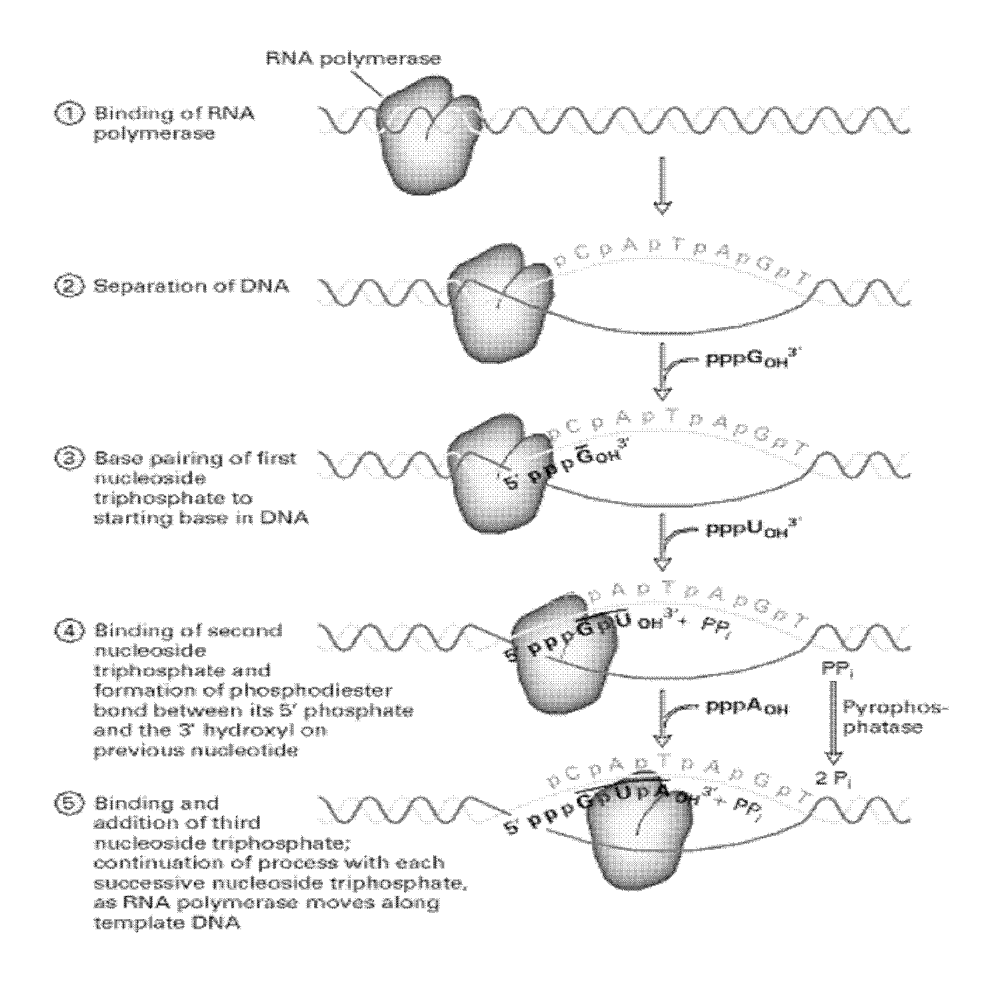
Toxin: A specific protein produced by certain plants, animals and microorganisms that is highly toxic to other organisms (snake venom). Also, it include all poisons.

Tracheostomy: Surgically creating an opening into the trachea.

Trans-acting: Referring to DNA sequences encoding diffusible proteins (e.g., transcription activators and repressors) that control genes on the same or different chromosomes. See also cis-acting.

Transcript: See primary transcript.

Transcription: Process whereby one strand of a DNA molecule is used as a template for synthesis of a complementary RNA by RNA polymerase. See next Figure:



RNA polymerase
① Binding of RNA polymerase
② Separation of DNA
③ Base pairing of first nucleoside triphosphate to starting base in DNA
④ Binding of second nucleoside triphosphate and formation of phosphodiester bond between its 5′ phosphate and the 3′ hydroxyl on previous nucleotide
⑤ Binding and addition of third nucleoside triphosphate; continuation of process with each successive nucleoside triphosphate, as RNA polymerase moves along template DNA
pCpApTpApGpT
pppG$_{OH}$ 3′
5′ pppG$_{OH}$ 3′
pppU$_{OH}$ 3′
5′ pppGpU$_{OH}$ 3′ + PP$_i$
pppA$_{OH}$
PP$_i$
Pyrophos-phatase
2 P$_i$
5′ pppGpUpA$_{OH}$ 3′ + PP$_i$

Transcription of DNA into RNA is catalyzed by RNA polymerase, which can initiate the synthesis of strands de novo on DNA templates:

The nucleotide at the 5′ end of an RNA strand retains all three of its phosphate groups; all subsequent nucleotides release pyrophosphate (PPi) when added to the chain and retain only their □ phosphate (red). The released PPi is subsequently hydrolyzed by pyrophosphatase to Pi, driving the equilibrium of the overall reaction toward chain elongation. In most cases, only one DNA strand is transcribed into RNA.

Transcription factor (TF): General term for any protein, other than RNA polymerase, required to initiate or regulate transcription in eukaryotic cells. General factors, required for

transcription of all genes, participate in formation of the transcription-initiation complex near the start site. Specific factors stimulate (or repress) transcription of particular genes by binding to their regulatory sequences.

Transcription-control region: Collective term for all the cis-acting DNA regulatory sequences that regulate transcription of a particular gene.

Transcription unit: A region in DNA, bounded by an initiation (start) site and termination site, that is transcribed into a single primary transcript.

Transfection: Experimental introduction of foreign DNA into cells in culture, usually followed by expression of genes in the introduced DNA.

Transfer RNA: See tRNA.

Transformation: Permanent, heritable alteration in a cell resulting from the uptake and incorporation of a foreign DNA. Also, conversion of a “normal” mammalian cell into a cell with cancer-like properties usually induced by treatment with a virus or other cancer-causing agent.

Transgene: A cloned gene that is introduced and stably incorporated into a plant or animal and is passed on to successive generations.

Transgenic: Referring to any plant or animal carrying a transgene.

Translation: The ribosome-mediated production of a polypeptide whose amino acid sequence is specified by the nucleotide sequence in an mRNA.

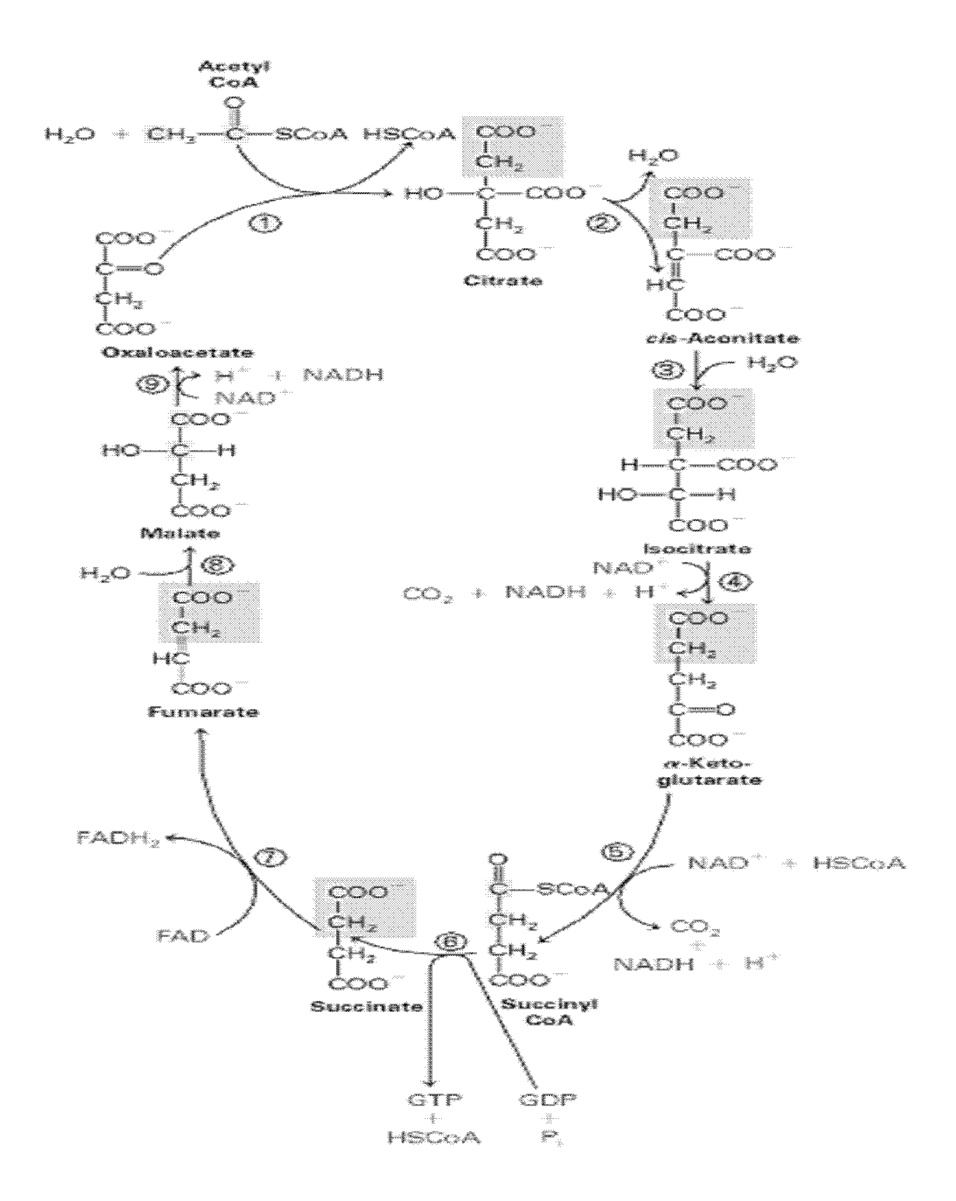
Translocon: Multiprotein complex in the membrane of the rough endoplasmic reticulum through which a nascent secretory protein enters the ER lumen as it is being synthesized.

Transport vesicles: Small membrane-bounded organelles that carry secretory and membrane proteins in both directions between the rough endoplasmic reticulum (ER) and the Golgi complex, and from the Golgi to the cell surface or other destination. Form by budding off from the donor organelle and release their contents by fusion with the target membrane.

Transposon: A relatively long mobile DNA element, in prokaryotes and eukaryotes, that moves in the genome by a mechanism involving DNA synthesis and transposition. See also retrotransposon.

Triage: Sorting casualties to determine priority of treatment.

Tricarboxylic acid cycle : See citric acid cycle . See next Figure: This is the most famous biochemical reaction and also the most important in the living cell :


Acetyl CoA
H₂O + CH₃—C—SCoA
HSCoA
HO—C—COO⁻
Citrate
H₂O
cis-Aconitate
H₂O
Isocitrate
NAD⁺
CO₂ + NADH + H⁺
α-Keto-glutarate
NAD⁺ + HSCoA
CO₂
NADH + H⁺
Succinyl CoA
GTP
HSCoA
GDP
Pᵢ
Succinate
FADH₂
FAD
Fumarate
H₂O
Malate
H⁺ + NADH
NAD⁺
Oxaloacetate

The citric acid cycle, in which acetyl groups transferred from acetyl CoA are oxidized to CO_2:

In reaction 1, a two-carbon acetyl residue from acetyl CoA condenses with the four-carbon molecule oxaloacetate to form the six-carbon molecule citrate. In the remaining reactions (2–9), each molecule of citrate is eventually converted back to oxaloacetate, losing two CO_2 molecules in the process. In four of the reactions, four pairs of electrons are removed from the carbon atoms: three pairs are transferred to three molecules of NAD^+ to form three NADH and three H^+; one pair is transferred to the acceptor FAD to form $FADH_2$. The two carbon atoms added from acetyl CoA are highlighted in blue. Note that they are not lost in the turn of the cycle in which they enter. Because fumarate is a symmetric molecule,

these two carbon atoms will be equally distributed among the four in oxaloacetate; one will be lost as CO2 during the next turn of the cycle and the other in subsequent turns.

Trituration: A process of reducing a solid to a very fine powder by grinding in a mortar and pestle.

TRNA (transfer RNA): A group of small RNA molecules that function as amino acid donors during protein synthesis. Each tRNA becomes covalently linked to a particular amino acid, forming an aminoacyl-tRNA.

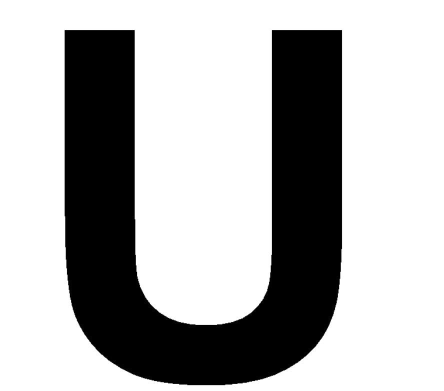
TSCA: Toxic Substances Control Act. It is federal law regulating chemicals in the environment. It is administered by the

Environmental Protection Agency.

Tubulin: A family of globular cytoskeletal proteins that polymerize to form microtubules.

Tumor: A mass of cells generally derived from a single cell, that is not controlled by normal regulators of cell growth. See Neoplasm

Tumor-suppressor gene: Any gene whose encoded protein directly or indirectly inhibits progression through the cell cycle and in which a loss-of-function mutation is oncogenic. Inheritance of a single mutant allele of many tumor-suppressor genes (e.g., RB, APC, and BRCA1) greatly increases the risk for developing certain types of cancer.



Ubiquitin: A small, highly conserved protein that becomes covalently linked to lysine residues in other intracellular proteins. Proteins to which a chain of ubiquitin molecules is added usually are degraded in a proteasome.

Uncertainty Factors: Factors used in the calculation of acceptable humans or environmental exposures. They are applied to data from laboratory experiments or epidemiology studies. Factors of 10 are normally used to account for such uncertainties in the data on which risk assessments are made. Similar to safety factors.

Uncoupler: An agent that dissipates the proton-motive force across the inner mitochondrial membrane and thylakoid membrane of chloroplasts, thereby inhibiting

ATP synthesis.

Unscheduled DNA Synthesis (UDS): The synthesis of DNA outside the normal mitotic process. It is considered an indication of DNA damage and the first step in the process of mutagenesis. The most commonly used test for UDS measures the uptake of tritium-labeled thymidine into the DNA of rat hepatocytes or human fibroblasts.

Upstream: The direction on a DNA opposite to the direction RNA polymerase moves during transcription. By convention, the +1 position in a gene is the first transcribed base; nucleotides upstream from the +1 position are designated −1, −2, etc. See also downstream.

Upstream activating sequence (UAS): Any protein-binding regulatory sequence in the DNA of yeast and other simple eukaryotes that is necessary for maximal gene expression; equivalent to an enhancer or promoter-proximal element in higher eukaryotes.

Uremia: A condition resulting from waste products not being removed efficiently by the kidneys so that they remain in the blood.

Urticaria: Hives or welts.



From Vapor Pressure: The pressure exerted when a solid or liquid is in equilibrium with its own vapor. The higher the vapor pressure the higher the volatility.

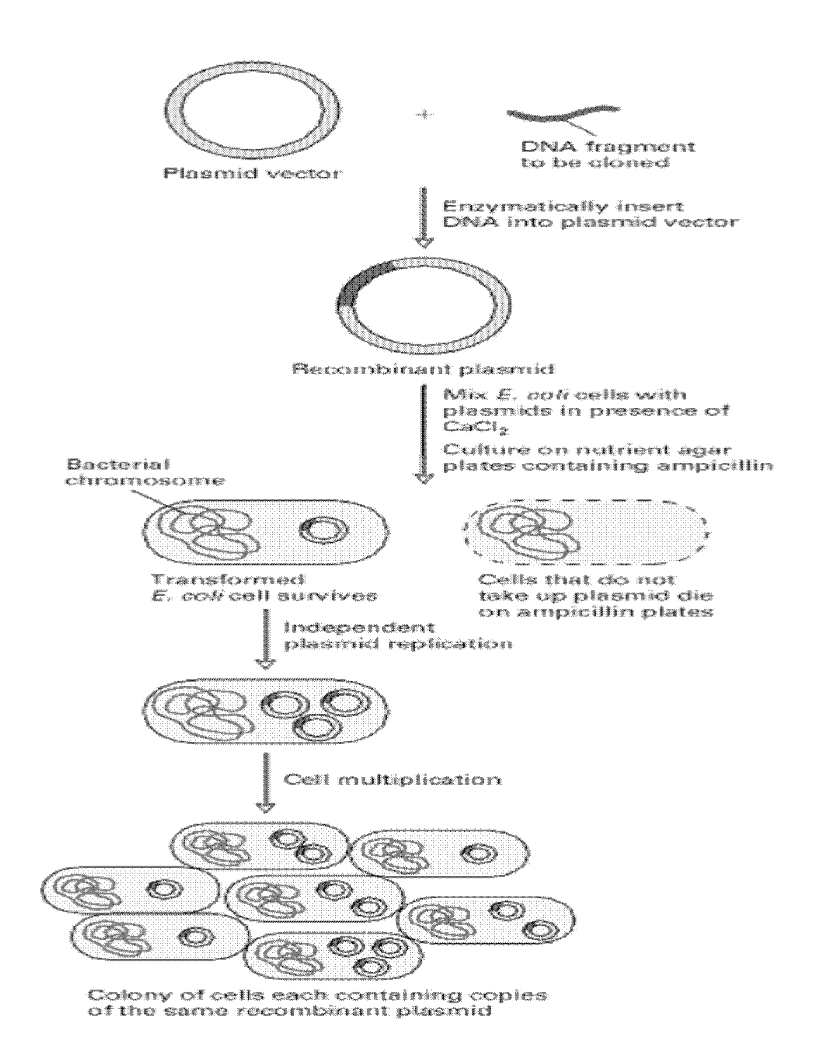
Van der Waals interaction: A weak noncovalent attraction due to small, transient asymmetric electron distributions around atoms (dipoles).

Vascular: Pertaining to blood vessels. AV-11.

Vasoconstrictor: An agent that constricts the blood vessels.

Vasodilator: An agent that dilates the blood vessels.

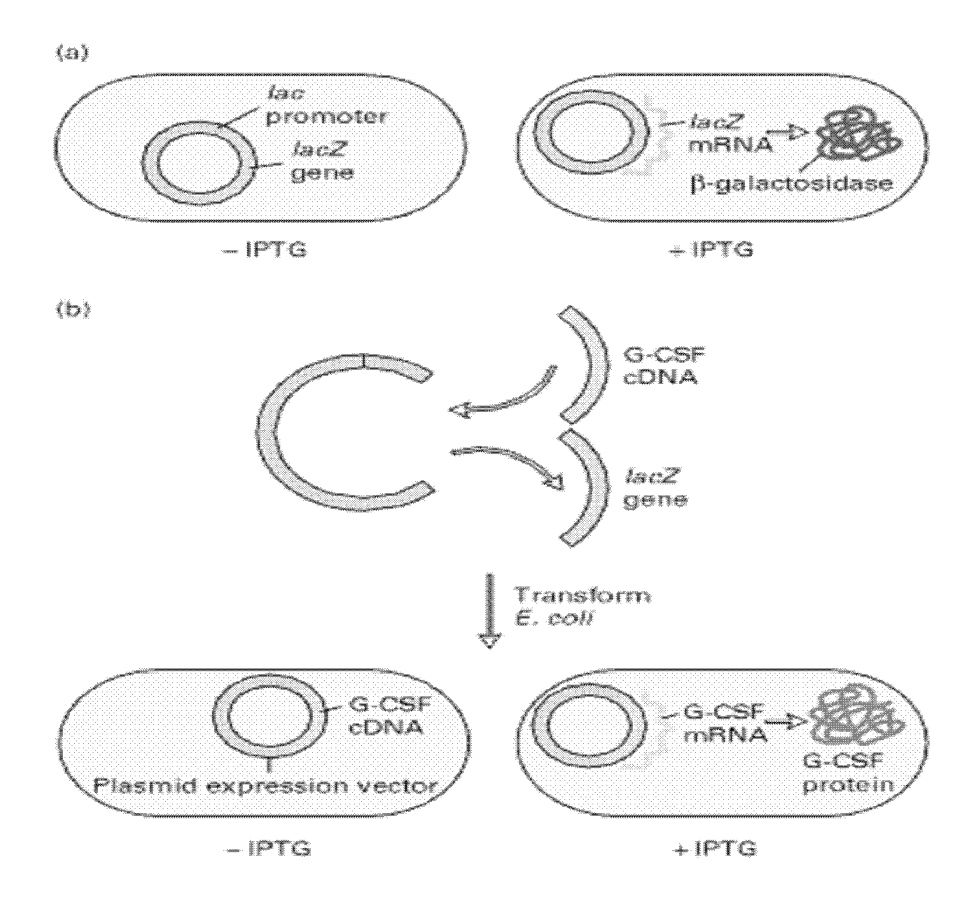
Vector: In cell biology, an agent that can carry DNA into a cell or organism. See also cloning vector and expression vector. The next Figure shows cloning vector:



General procedure for cloning a DNA fragment in a plasmid vector:

Although not indicated by color, the plasmid contains a replication origin and ampicillin-resistance gene. Uptake of plasmids by E. coli cells is stimulated by high concentrations of CaCl2. Even in the presence of CaCl2, transformation occurs with a quite low frequency, and only a few cells are transformed by incorporation of a single plasmid molecule. Cells that are not transformed die on ampicillin-containing medium. Once incorporated into a host cell, a plasmid can replicate independently of the host-cell chromosome. As a transformed cell multiplies into a colony, at least one plasmid segregates to each daughter cell.

The next Figure shows expression vector:



A simple E. coli expression vector utilizing the lac promoter:

(a) The expression vector plasmid contains a

fragment of the E. coli chromosome containing the lac promoter and the neighboring lacZ gene. In the presence of the lactose analog IPTG, RNA polymerase normally transcribes the lacZ gene, producing lacZ mRNA, which is translated into the encoded protein, b-galactosidase. (b) The lacZ gene can be cut out of the expression vector with restriction enzymes and replaced by the G-CSF cDNA. When the resulting plasmid is transformed into E. coli cells, addition of IPTG and subsequent transcription from the lac promoter produces G-CSF mRNA, which is translated into G-CSF protein.

Ventral: Relating to the front of an animal or lower surface of a structure (e.g., wing or leaf).

Vermicide: A drug that expels worms without necessarily killing them.

Vesicant: A blistering drug or agent.

Vesication: The process of blistering.

Vesicle: A small blister.

Virion: An individual viral particle.

Virulence: The degree of pathogenicity of a microorganism or its ability to invade the tissues of the host.

Virus: A small parasite consisting of nucleic acid (RNA or DNA) enclosed in a protein coat that can replicate only in a susceptible host cell; widely used in cell biology research.

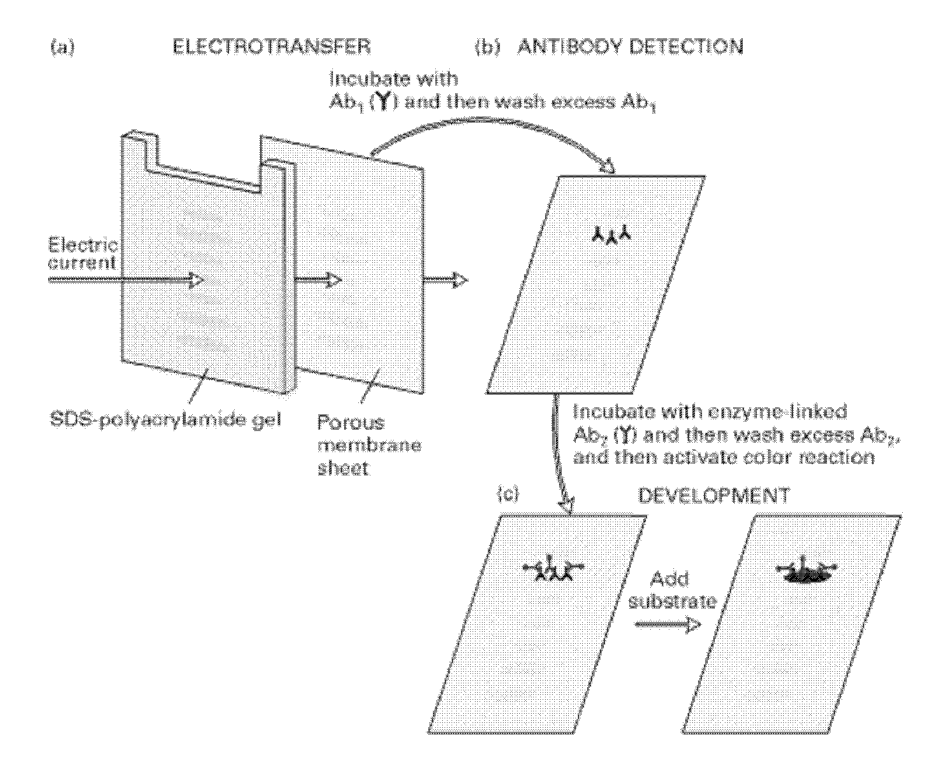
Vmax: Parameter that describes the maximal velocity of an enzyme-catalyzed reaction or other process such as protein-mediated transport of molecules across a membrane.

Volatility: The ability of a substance to change from liquid or solid form to a gaseous form.



Waters: Aqueous solutions of volatile substances.

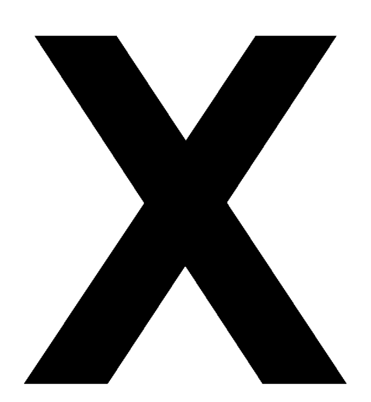
Western blotting: Technique for detecting specific proteins separated by electrophoresis by use of labeled antibodies. See next Figure:



Western blotting, or immunoblotting:

(a) A protein mixture is electrophoresed through an SDS gel, and then transferred from the gel onto a membrane. (b) The membrane is flooded with a solution of antibody (Ab1) specific for the desired protein. Only the band containing this protein binds the antibody, forming a layer of antibody molecules (although their position can't be seen at this point). After sufficient time for binding, the membrane is washed to remove unbound Ab1. (c) In the development step, the membrane first is incubated with a second antibody (Ab2) that binds to the bound Ab1. This second antibody is covalently linked to alkaline phosphatase, which catalyzes a chromogenic reaction. Finally, the substrate is added and a deep purple precipitate forms, marking the band containing the desired protein.

Wild type: Normal, non mutant form of a macromolecule, cell, or organism.



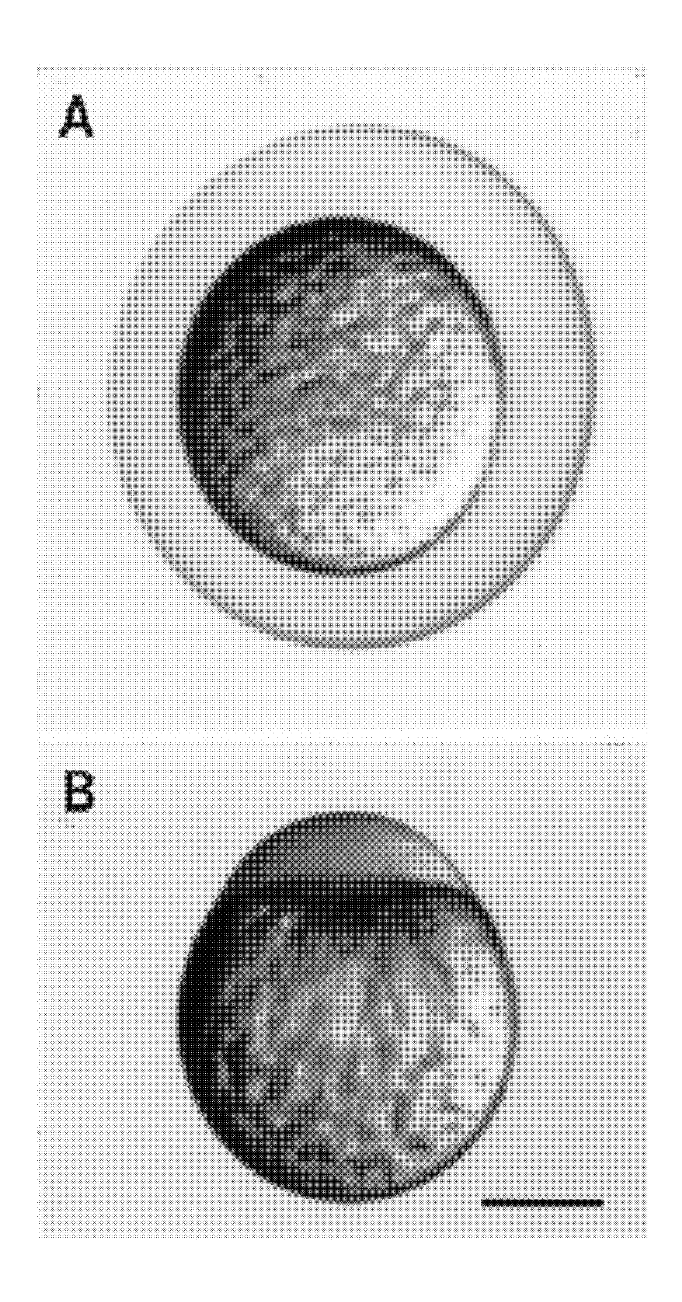
Xenobiotic: A chemical foreign to the body.

X-ray crystallography: Most commonly used technique for determining the three-dimensional structure of macromolecules (particularly proteins and nucleic acids) by passing x-rays through a crystal of the purified molecules and analyzing the diffraction pattern of discrete spots that results.

Z

Zinc finger: Several types of conserved DNA-binding motifs composed of protein domains folded around a zinc ion; present in several types of eukaryotic transcription factors.

Zygote: A fertilized egg; diploid cell resulting from fusion of a male and female gametes (ovum and sperm). Next Figure shows two stages in zygote life as a fertilized egg appears which is then granulated till further cell divisions:


A
B

Special Endocrinology Definitions

Adenoma: A begin tumor of an endocrine gland, such as a parathyroid adenoma.

Adrenaline: The hormone secreted by the central part (medulla) of the adrenal gland.

Anaplastic Thyroid Cancer: A rare type of thyroid cancer that spreads rapidly. This is the least common but most deadly of all thyroid cancers.

Antithyroid Drugs: Medications that slow down the thyroid gland's ability to produce thyroid hormone. There are several different types, but most interfere with the thyroid's ability to synthesize hormone.

Benign: Non-cancerous.

Beta Blocking Drug: Medications that help block the symptoms (palpitations, tremor) caused by excess thyroid hormone.

Calcitonin: A hormone produced by medullary thyroid cancer. Its measurements in the blood is a sensitive test for early diagnosis, as well as detecting recurrance following an operation for medullary thyroid cancer.

Cold Nodule: A lump in the thyroid gland that does not take up iodine on a scan as well as the surrounding thyroid tissue. Cancers show on a scan as cold nodules but most cold nodules are not cancer.

Compensatory Goiter: Thyroid enlargement due to inefficient thyroid tissue that compensates for its inefficiency by enlarging.

De Quervain's Thyroiditis: Inflammation of the thyroid gland causing enlargement and pain. It often causes fever and symptoms of hyperthyroidism.

Desiccated Thyroid: A crude preparation made of animal thyroid glands. It was the first available source of thyroid hormone (thyroxine). Because of poor absorption and impurities it is no longer used.

Diffuse Goiter: Generalized enlargement of the entire thyroid gland with a smooth surface.

Exophthalmos: Protrusion of the eyes in Graves ' disease.

Follicular Thyroid Cancer: The second most common form of thyroid cancer. Usually curable by thyroid surgery.

Goiter: Enlargement of the thyroid gland for any reason. It may be generalized enlargement (diffuse) or asymmetric (nodular).

Graves ' disease: Hyperthyroidism caused by an overactive diffuse goiter often associated with exophthalmos. Described by Dr. Robert Graves.

Hashimoto's Thyroiditis: Inflammation of the thyroid gland described by Dr. Hashimoto. Typically causes a goiter and results in hypothyroidism.

Hormone: A chemical produced by an endocrine gland and released into the blood. It travels to other organs of the body where it produces its effect.

Hot Nodule: A lump in the thyroid gland that concentrates iodine on a scan more than the normal surrounding thyroid tissue . Hot nodules are very rarely cancerous.

Hyperthyroidism: Symptoms of increased metabolism due to excess thyroid hormone in the blood. It may be due to an abnormal thyroid gland or from taking thyroid medication.

Hypothyroidism: Symptoms of decreased metabolism due to a deficiency of thyroid hormone in the blood.

Inderal: A beta-blocking drug.

Hyperparathyroidism: Overproduction of parathyroid hormone (PTH) by a diseased parathyroid gland. The excess PTH causes the calcium to be too high, leading to kidney stones, osteoporosis, and several nevous system complaints.

Iodine: A non-metallic element found in food. It is necessary for normal thyroid function.

Iodine-Induced Goiter: A goiter caused by excess iodine or by a sensitivity to iodine.

Isthmus: A small piece of thyroid tissue that connects the right and left lobes of the thyroid gland.

Larynx: The top of the trachea containing the vocal cords. The "voice box".

Lithium: A metal, the salt of which is used in treating depression. It sometimes interferes

with thyroid function and can cause goiter.

Lugole's Solution: A liquid medication containing iodine.

Malignant: Cancerous.

Medulla: The central part of a gland, such as the adrenal medulla.

Medullary Thyroid Carcinoma: A rare form of thyroid cancer that produces an abnormal hormone (calcitonin). This form of thyroid cancer is often hereditary.

Metabolism: The use of calories and oxygen to produce energy.

Methimazole: An antithyroid medication used to treat hyperthyroidism.

Multi-Nodular Goiter: Enlarged thyroid gland with two or more nodules.

Myxedema: Severe hypothyroidism.

Neoplasm: A tumor. An abnormal growth. May be benign or malignant.

Nodular Goiter: Enlarged thyroid gland with one or more nodules.

Nodule: A lump or growth of tissue within the thyroid gland.

Osteoporosis: The process by which too much calcium is lost from the bones which causes the bones to become brittle. Associated with aging, but made much worse by hyperparathyroidism.

Palpitation: The sensation of feeling your heart beat. It may be too fast, irregular, or just more forceful.

Papillary Thyroid Carcinoma: The most common form of thyroid cancer; usually curable by surgery.

Parathyroid Glands: Four small glands

located in the neck, near the thyroid gland. They produce parathormone which controls calcium metabolism. Production of too much parathyroid hormone causes primary hyperparathyroidism and osteoporosis.

Pheochromocytoma: A tumor of the adrenal medulla which secretes adrenaline.

Pituitary Gland: A small gland the size of a peanut that is located behind the eyes of the base of the brain. It secretes hormones that control other glands (thyroid, adrenal, testicles and ovaries) as well as growth. It secretes TSH which helps control thyroid function.

Parathyroid Hormone (PTH): Hormone secreted by the parathyroid glands. Circulates in the blood stream to cause absorption of calcium from our diets, and out of bones.

Propylthiouracil (PTU): An antithyroid medication which prevents thyroid cells from producing thyroid hormone. Used to control hyperthyroidism.

Radioactive Iodine: An isotope of iodine used in the diagnosis and treatment of the thyroid lesions and thyroid cancers.

Scan: A term which generically means a "picture" of some part of the body.

Silent Thyroiditis: A self limited thyroiditis that resembles Hashimoto's thyroiditis on biopsy but De Quervain's thyroiditis on scan.

Thyroid Stimulating Hormone (TSH): A hormone produced by the pituitary that stimulates the thyroid gland. Its measurement is a very sensitive test of thyroid status.

Thyroid Binding Globulin (TBG): A protein in the blood that binds with thyroxine (T4).

Thyroglobulin: A protein in the thyroid gland, a small amount of which gets into the blood. Its level is followed after thyroid surgery to detect recurrence of thyroid cancer.

Thyroidectomy: An operation removing all or part of the thyroid gland.

Thyroiditis: Inflammation of the thyroid gland.

Thyroxine (T4): The primary hormone produced by the thyroid gland. It is available as medication.

Toxic Goiter: An enlarged thyroid gland that produces too much thyroid hormone.

Trachea: The windpipe. It should me in the middle of the neck but can be pushed to the side by a large goiter, especially a substernal goiter.

TRH Test: A very sensitive test for abnormal thyroid function.

Triiodothyronine (T3): The second hormone produced by the thyroid gland. It is more potent than thyroxine (T4).

Tumor: A mass of tissue. It may be benign or malignant.

Ultrasound: A type of scan which uses sound waves which pass into the body, reflecting back to produce pictures.

Reference ranges for common blood tests

(Normal values for human metabolites)

A reference range is a set of values used by a health professional to interpret a set of medical test results. The range is usually defined as the set of values 95% of the normal population falls within. It must be remembered that the reference range will vary, depending on the age, sex and race of a population, and even the machines the laboratory uses to do the tests. Also remember that by definition 5% of the normal population will fall outside the reference range. These are approximate adult values that are intended as a guide to students and those interested, they are not a substitute for medical advice.

Clinical biochemistry

Test	Range	Comments
Sodium (Na)	130 - 145 mmol/L	
Potassium (K)	3.5 - 5.0 mmol/L	
Urea	2.6 - 6.8 mmol/L or 10 - 20 mg/dL	(BUN - blood urea nitrogen)
Creatinine	50 - 110 µmol/L or <1.5 mg/dL	
Glucose (fasting)	4.2 - 6.1 mmol/L or 75-115 mg/dL	
Total Protein	60 - 80 g/L	
Albumin	30 - 50 g/L	

Total Bilirubin	2 - 14 µmol/L	
Direct Bilirubin	0 - 4 µmol/L	
Alanine transaminase (ALT)	8 - 40 U/L	Also called serum glutamic pyruvic transaminase (SGPT)
Alkaline phosphatase (ALP)	40 - 130 U/L	Higher in children and pregnant women.
Gamma glutamyl transferase	< 50 U/L	

Creatine kinase (CK)	22 - 198 U/L	
Aspartate transaminase (AST)	8 - 35 U/L	
Lactate dehydrogenase (LDH)	85 - 285 U/L	
Amylase	25 - 125 U/L	
C-reactive protein (CRP)	<8 mg/L	
D-dimer	<500 ng/ml	

Other ions and trace metals

Ionised calcium (Ca)	1.15 - 1.29 mmol/L	Some calcium is bound to albumin, thus not measured by certain techniques.

Total calcium (Ca)	2.05 - 2.55 mmol/L	
Copper (Cu)	11 - 26 μmol/L	
Zinc (Zn)	10 - 17 μmol/L	

Lipids

Triglycerides	0.4 - 2.0 mmol/L	
Total cholesterol	3.0 - 5.5 mmol/L	
HDL cholesterol (male)	0.7 - 1.9 mmol/L	
(female)	0.9 - 2.4 mmol/L	

LDL cholesterol	2.4 - 4.0 mmol/l	Not valid when triglycerides >5.0 mmol/L.

Tumour markers

Alpha-fetoprotein (AFP)	1-15 kIU/L	
CA-125	<65 kU/L	
Prostate specific antigen (total PSA)	<2.0 µg/L	After age 40, normal levels increase every decade.

Hormones

Thyroid stimulating hormone (TSH)	**0.5 - 4.7 mIU/L**	**Also called: Thyrotropin**
Free thyroxine (FT4)	**9.0 - 24 pmol/L**	
Free triiodothyronine (FT3)	**2.5 - 5.3 pmol/L**	
Adrenocorticotropic hormone (ACTH)	**1.3 - 15 pmol/L**	
Cortisol (0830 h)	**250 - 850 nmol/L**	**Cortisol levels are higher in the morning than at night.**
Cortisol (1630 h)	**110 - 390**	

	nmol/L	
Prolactin (male)	<450 mIU/L	
(female)	<580 mIU/L	
Testosterone (male)	8 - 38 nmol/L	
(male prepuberty)	0.1 - 0.5 nmol/L	
(female)	0.3 - 2.5 nmol/L	

Hematology

Red blood cells

Haemoglobin	130 - 180	Higher in neonates, lower in

(Hb) (male)	g/L	children.
(female)	115 - 160 g/L	Sex difference negligible until adulthood.
Haematocrit (Hct) (male)	0.38 - 0.52	
(female)	0.35 - 0.47	
Mean cell volume (MCV)	80 - 98 fL	Cells are larger in neonates, though smaller in other children.
Mean cell haemoglobin (MCH)	26 - 34 pg	
Red cell count (male)	4.5 - 6.5 x1012/L	

(female)	3.8 - 5.8 x1012/L	
Reticulocytes	10 - 100 x109/L	
Erythrocyte sedimentation rate (ESR)	<20 mm/hr	Females tend to have a higher ESR. ESR increases with age.

White blood cells

The Total white blood cells	4.0 - 11.0 x109/L		Higher in neonates and infants.
Neutrophil granulocytes	2.0 - 7.5 x109/L	45-74%	Also known as granulocytes (grans), polys, PMNs,

			or segs.
Lymphocytes	1.0 - 4.0 x109/L	16-45%	
Monocytes	0.0 - 0.8 x109/L	4.0-10%	
Eosinophil granulocytes	0.0 - 0.5 x109/L	0.0-7.0%	
Basophil granulocytes	0.0 - 0.2 x109/L	0.0-2.0%	

Coagulation

Platelets	150 - 400 x109/L	Platelets are part of the formation of

		blood clots
Prothrombin time (PT)	7 - 10 s	
INR	0.8 - 1.2	The INR is a corrected ratio of a patients PT to normal
Activated partial thromboplastin time (APTT)	29 - 41 s	
Thrombin clotting time (TCT)	11 - 18 s	
Fibrinogen	1.8 - 4.0 g/L	
Bleeding time	2 - 8 minutes	

[The prothrombin time (PT) and its derived

measures of prothrombin ratio (PR) and international normalized ratio (INR) are measures of the extrinsic pathway of coagulation. They are used to determine the clotting tendency of blood, in the measure of warfarin dosage, liver damage and vitamin K status. The reference range for prothrombin time is 7-10 seconds; the range for the INR is 0.8-1.2.

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